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ENGINEERING NEWS.

A PHILADELPHIA WATER SUPPLY, from Delaware Water Gap, is the object of a proposition sent to the Mayor of Philadelphia by RUSSEL L. THAYER, Chief Engineer of Fairmount Park. The scheme is practically the same as that prepared by Mr. RUDOLPH HERING for Col. LUDLOW when the latter was Chief Engineer of the Philadelphia water department. It means a gravity conduit from the Gap emptying into the Cambria or highest reservoir in the city. It would have a capacity of 210,000,000 galls. daily, delivered 170 ft. above city datum. The length of the conduit would be about 81 miles and its estimated cost is $18,000,000. The exact terms of the proposition are not known to us, and the names of the capitalists behind it are yet unpublished, but it would be a private enterprise such as was suggested about a year ago.

A WATER SUPPLY for the Pabst Brewing Co., of Milwaukee, Wis., is now being secured by Gray Bros. of that city. An 8-ft. shaft is down 85 ft. and will be sunk to a depth of 110 ft. The formation at the depth of 85 ft. is of clay, thoroughly puddled with water. When the shaft is completed, three holes, about 300 ft. deep, will be drilled into the Niagara limestone, and from these it is expected that from 400 to 600 galls. of water per minute will be secured. The shaft is about 1¼ miles from Lake Michigan, and the surface of the ground at this point is 83 ft. above the surface of Lake Michigan. As the water will come from the lake, the lower part of the shaft will serve as a reservoir.

In sinking an artesian well 1,600 ft. deep in this locality, 6 years ago, Gray Bros. found that the Niagara limestone at 400 ft. from the surface absorbed 300 galls. of a flow of 500 galls. per minute. There are 5 artesian wells in the vicinity of Milwaukee that were drilled through from 30 to 50 ft. of open Niagara limestone, and as one well has already been sunk at the brewery which feeds 300 galls. per minute to the rock, it is thought that not so much will be absorbed from those now being put down.

THE CONNECTICUT STATE SURVEY, lately authorized by the Legislature, is now in progress, under Commissioners Prof. Wm. H. BREWER, of Yale College, Rev. JAMES H. CHAPIN, and JOHN W. BACON, C. E. The triangulation is now in hand and it is expected that half the State will be surveyed by December next, and all the field work finished during the next season. The State has been already divided into 25 districts of about 200 sq. miles each for triangulation, this work being in charge of Mr. S. S. GARRETT.

THE THAMES DRAWBRIDGE, over the river of that name at New London, Conn., will be opened to travel next month. It was commenced about nine months ago by the New York, Providence & Boston R. R. The superstructure is steel throughout and the draw is 502 ft. long, offering two clear openings, of 225 ft. each. On either side of the draw are spans of 310 and 152 ft. making the total length of the bridge 1422 ft. The depth of water at the pier sites varies from 5 to 57 ft. and the depth of soft mud, etc., penetrated is from 10 to 80 ft. At the draw and two flanking piers the depth of foundations range as follows; center pier 128 ft., left pier 130 ft., right pier 103 ft. The foundations consisted of timber cribs driven full of piles cut off at the surface of the mud and covered with concrete. The masonry was built in caissons and sunk upon the concrete base. The draw contains 2,400,000 lbs. of metal.

A BRIDGE AND TOW-BOAT WAR was inaugurated on July 22, at Steubenville, on the Ohio river. The Pan Handle Co. recently obtained Government permission to close up the channel at this point for the purpose of replacing the channel span of their bridge. The river men appealed against this decision in vain; and when the coal fleet arrived, on July 22, the channel was almost shut off by piling. Without warning to the workmen, a tow boat, with three barges abreast, came down upon the piles, breaking down 25 and smashing the pile driver; the workmen barely escaped with their lives. Later another tow broke out 33 more piles. The question to be settled is whether the railroad has the right to impede river navigation so that trains may continue running. Both parties are determined to protect their "rights," and the Government must decide between them.

THE ST. CLAIR TUNNEL caved in on July 26, according to a Sarnia dispatch. The bank of the west end of the tunnel excavation for a distance of about 100 ft. south slid down from 15 to 20 ft. The earth going down forced up a distance of several feet the bottom of the hole where the shield for work at the tunnel proper was to be placed. About three hours later the bank on the south side of the excavation for a length of 200 ft. gave way and slid in to the excavation. The trouble is apparently a serious one, and it is impossible to say yet what will be the result.

THE OTIS IRON AND STEEL WORKS, at Cleveland, O., have been transferred to a British company, and the shares have just been floated in London. The capitalization is $4,365,000 (£900,000), divided equally into common stock, 8 per cent. cumulative preference stock, and 6 per cent. bonds. The prospectus of the company gives the history and status of the Otis works as follows: The original works were built 15 years ago and now employ over 1,000 hands, and occupy about 24 acres of ground. The principal products are boiler and ship plates, tires, axles, forgings, billets, etc.; and about half the output is now used by Cleveland ship-builders and wire mills. The total capacity of the works is about 80,000 tons per annum. The net profits of the works have been as follows:

1887	$ 527,316
1888	518,291
1878-1888, ten years	5,453,256

The promoters of the new company estimate that the future profits will be at least equal to those of 1888, and sufficient to provide for an annual dividend of 20 per cent. on the common stock of the company.

THE GUNS OF THE CRUISER "*Yorktown*" were successfully tested at sea on July 29. The main battery of the new cruiser consists of six 6-in. rifles. The charges were 32 lbs. of pierced prismatic powder and an ordinary steel shell of 110 lbs. The elevation of the guns ranged from level to 3°, 7°, and 10°. Everything worked admirably in service and gun-carriages. The one bad point developed, however, was that the quarters for the crew were cramped and insufferably hot with the water-tight compartments closed. The test was carried on in a very heavy sea.

FOREIGN HOLDERS OF PERUVIAN BONDS will be pleased to learn of the favorable progress made toward a settlement of the questions at issue between them and the Government. The Peruvian Chamber of Deputies has approved the first 7 articles of an agreement under which all the Peruvian railroads and all franchises for their extensions are ceded to the bondholders with all present Government claims against the lessees of the roads and the right to navigate Lake Titicaca and the Government waterways between Orequarpa and Mollendo. The bondholders also receive £80,000 annually for 30 years. The negotiations were conducted, on behalf of the bondholders, by W. R. Grace & Co., of this city.

THE CARSON RIVER WATERSHEDS, in Nevada, have recently been inspected by Col. BRIDGES of the U.S. Geological Survey, with the purpose of finding sites for reservoirs to store water for irrigation purposes. It is reported that at least six good sites for reservoirs were found, and that a site for a dam has been selected one quarter of a mile above the junction of Wolf creek and East fork, the latter being a tributary of the Carson river. It is said that the proposed dam would form a reservoir having an area of from 3 to 4 sq. miles.

THE MOST SERIOUS RAILWAY ACCIDENT OF THE WEEK was the derailment of a passenger train, July 27, near Brighton, Tenn., on the Chesapeake, Ohio & Southwestern. Three persons were killed.——Another serious derailment was that of a freight train on the East Tennessee road near Brunswick, Ga., July 21. The engine was running tender first, when the tender jumped the track, and the engine fell over on its side. The engineer and fireman were killed, and 3 men were seriously injured, 1 fatally.——A head collision occurred July 26 on the Sand Coulee branch of the Manitoba road, near Helena, Mont., between a coal and a cattle train, both running wild. One man was injured.——A serious crossing collision occured on the New York, Lake Erie & Western Railway near Rock Glen, N. Y., July 29. Some cars were being shifted to the salt works switch. These cars formed part of a Lehigh Valley coal train. The Lehigh Valley uses the Erie tracks between Waverly and Buffalo. The main body of the train was left standing at a crossing while the switching was being done. It is claimed that the conductor failed to send out a flagman to protect his train. Another westbound coal train came down the grade, and when, after rounding a curve just east of Rock Glen, the engineer caught sight of the cars, it was too late to stop. The engine fell over and 22 coal cars were piled in a wreck over it. The track was torn up. Nobody was injured.

BRIDGE ACCIDENTS due to the floods are quite numerous, and among bridges reported as washed away are the following: highway bridge at Maplewood, N. J.; 30 of the 52 large bridges in Union county, N. J.; highway bridges at Snow Hill, Md., and Laurel, Del.; Danville & New River Railway bridge at Cascade, Va.; bridges at Saulsbury and in Lee, Tygart, State and Steel counties, W. Va.; highway bridge at Fredonia, Kan.; Kansas Central Railway bridge at Oneiga, Kan.

A BRIDGE ACCIDENT in India is reported as follows in *Indian Engineering* of June 29. "On Wednesday last, on the East Indian Railway, between Kar matar and Madhupore, as a passenger train was crossing the Jynthee bridge, the bridge suddenly collapsed. There were no trains wrecked, nor were any lives lost. All through trains will have to go for the next fortnight by the Loop Line, as it is calculated that it will take that time before the damage can be repaired."

THE REMARKABLE SUCCESSION OF HEAVY RAIN STORMS which have been reported for some weeks past still continues. During the week very heavy storms have occurred in New York, New Jersey, and other Atlantic States, swelling the rivers and causing much damage by floods. In New England, floods occurred in the valleys of the Hoosac, Naugatuck, and Housatonic. Several small bridges have been carried away, and washouts have occurred on the Housatonic Railway. In New York there has

been a heavy rainfall with severe storms; washouts have occurred on several railways, and traffic was considerably interfered with by the floods. A cyclone caused some damage in Ulster county. In New Jersey the rainfall was very heavy, causing floods which washed away bridges and buildings and did other damage. Coddington's dam on Stony brook, near Plainfield, and the dam at Feltville, were carried away; altogether 8 dams near Plainfield are said to have been destroyed. Dams at Bloomfield, Milburn, and Belleville were also destroyed. Numerous washouts are reported. In Plainfield the floods damaged buildings to the extent of several thousand dollars. In Maryland, Delaware, Virginia, and West Virginia much damage has been done. The storms also extended over the northwest to Dakota, and southwest to Kansas and Arkansas.

WASHOUTS AND LANDSLIDES have occurred on a number of railways as a consequence of the heavy storms and floods.——A landslide on the Northern Pacific, which occurred near Miles City, Mont., July 20, is one of the most extensive and disastrous in the history of the road. It happened on a point of the Yellowstone division where the track skirts Yellowstone river, with the turbulent stream on one side and a high alkali bank on the other. Without warning or apparent cause, this bank gave way and the mass of earth for a distance of 500 ft. along the track and 300 ft. slid away down to the river, completely burying the railway.——On July 25, the bank of the west end of the tunnel excavation at Sarnia, Ont., for a distance of about 100 ft. south, slid down from 15 to 20 ft. Later the bank on the south side of the excavation for a length of 200 ft. gave way. The trouble is reported to be serious.

PETROLEUM DEPOSITS are reported to have been discovered near the summit of the Rocky Mountains in eastern British Columbia by A. P. PATRICK, a Dominion land surveyor of Calgary. The oil is said to be of especially fine quality.

PROJECTORS OF NEW RAILWAY LINES will be interested in a decision just made by the Georgia Supreme Court, in the case of the Georgia Improvement Co. vs. P. H. SNOOK, of Atlanta. When the Atlanta & Florida Railway enterprise was first started, it was proposed to build from Atlanta to Hawkinsville, and the stock of the company was fixed at $250,000. With this understanding, Mr. SNOOK subscribed for $250 of the stock. Afterward the southern terminus was changed to Thomasville, Ga., and the capital stock of the company was increased to $2,000,000, both of which changes were made without the consent or approval of Mr. SNOOK, and he refused to pay his subscription. In a suit brought in the Atlanta City Court, it was decided that he must pay, but the higher court reversed the decision.

THE MICHIGAN LEGISLATURE has passed a law fixing maximum rates of passenger fare in proportion to the gross earnings per mile in 1888 as follows:

Roads which earned	$3,000 or over per mile,	2 cts. per mile,
" " "	$2,000 to $3,000 " "	2½ " " "
" " "	less than $2,000 " "	3 " " "

Roads in the upper peninsula may charge 3 cents if their gross earnings exceeded $3,000, and 4 cents if they were less than $3,000. The act does not apply to roads less than 15 miles in length. Another clause compels the sale of thousand-mile tickets at $20 in the lower and $25 in the upper peninsula.

Other acts passed provide that after Nov. 1, 1889, cars shall be heated by steam from the engine, or some other equally safe device in the discretion of the railroad commission. It is also required that after Oct. 1, 1890, all engines and tenders shall be provided with air brakes.

Mr. STEVENSON TOWLE was appointed on July 31 Consulting Engineer in charge of the new pavements for New York City, at a salary of $6,000 per annum.

Mr. ALPHONSE FTELEY, Chief Engineer of the New Croton Aqueduct, sailed for Europe on a month's vacation on July 31. Deputy Chief Engineer GEORGE S. RICE is in charge meanwhile.

Accidents on Public Highways in Paris.

M. H. de BAECKER, in *Le Génie Civil* of June 29, 1889, says that statistics show that in Paris alone vehicles cause annually about 1,600 accidents, of which 1,100 are followed by death. In France itself there are about 13,000 accidents per year resulting in death: but statistics are wanting to make any exact analysis of the causes in the latter case.

But in Paris the records are more carefully kept, and the following figures are taken from the weekly returns of the Department of Police. Accidents resulting from the handling of machinery are omitted as not entering into this subject:

Nature of Accidents.	1885.				1886.				1887.			
	Killed.		Hurt.		Killed.		Hurt.		Killed.		Hurt.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
Vehicles	901	406	63	9	1,135	500	37	13	1,088	432	87	15
Falling bodies	159	16	67	7	193	26	54	9	282	28	72	17
In the river	190	28	27	2	168	19	34	2	145	29	32	5
Various	951	227	125	54	1,182	259	122	55	1,074	294	128	113
Total	2,205	677	282	72	2,678	804	247	79	2,500	785	319	150

For the last ten years the mean annual record would be as follows: killed, 2,454 men and 719 women; hurt, 292 men and 84 women. It should also be remarked that the very appreciable increase in women killed in 1887 is due to the burning of the Opera Comique in that year.

The author goes on to say that a study of the accidents upon the public highways divides itself under two very distinct heads; the first including the means of preventing accidents, and the other the help to be given when accidents occur. Under the first head he says, the public should not depend so implicitly upon the vigilance of the agents of the city; but, on the other hand, these agents are sufficiently armed with authority to suppress altogether certain causes of accident and to reduce the effect of others, if they will better enforce the city regulations.

M. BAECKER then describes the system of city ambulances established in June, 1888, at the hospital of St. Louis in the city of Paris. This establishment is in telephonic communication with 29 telephone "calls," spread over a territory having a radius of about two miles from the hospital as a center, so that an ambulance can generally be secured within 10 or 15 minutes after the call is made. The ambulance itself is fitted with a spring bed on rollers, cases of instruments, etc., a "Geneva Cross" flag, and alarm bell, and other accessories very much like the similar service in the city of New York, from which our author practically says that the system is copied. The annual sum of $80,000 is appropriated for this service.

During 1887 the ambulance at the hospital of St. Louis was called 18 times in June, 65 in July, 68 in August, 99 in September, 110 in October, and 120 times in November. Since then the number has been constantly increasing as the service became better known and its intent and usefulness better understood. A more general ambulance service is now proposed for all Paris, with thoroughly equipped stations in each *mairie*, so that in case of a simultaneous demand 20 ambulances could be despatched to the scene of any great accident and thus provide for 80 victims at one time. This latter service would include 300 call stations in the kiosks scattered through the various *arrondissements*, and each kiosk would be in telephonic communication with the office of the mayor of that section, and be provided, besides, with proper means of giving temporary relief to the wounded party.

THE TRANSCONTINENTAL ASSOCIATION is trying to adjust the differences of its members so that all may be peace and harmony once more. The Northern Pacific and Union Pacific still show some tendency to spit fire at each other over the disputed question of the Puget Sound passenger rate business; but the chief difficulty is between the Canadian Pacific and Southern Pacific concerning the size of the differential which the former shall be allowed. Probably the trouble will be patched up. No company can afford a rate war on Pacific coast business this year.

Abysses of the Pacific Ocean.

The peculiarity of the Pacific Ocean is that it can be divided into two distinct parts, the dividing line being the meridian of 150 degrees west. The eastern half, that which laves our shores, is remarkable for the absence of islands and the uniform nature of its depth, for, with the exception of the narrow strip of shallow water surrounding the Aleutian Islands, and running along the American coast, the sounding line shows an average depth of from 2,000 to 3,000 fathoms, undiversified by any remarkable elevations or depressions. The only noteworthy exception to this great and equal depth is a great submarine plateau, which extends out from the Patagonian coast, and rises to between 2,000 and 1,000 fathoms from the surface. This plateau is horn-shaped, and is evidently a connecting link between the South American continent and the Australian archipelago. The western half of the Pacific ocean is a complete contrast to the eastern. Archipelagos and scattered islands are exceedingly numerous, and the depth of the ocean is uniform, shallows occurring scattered over it at irregular intervals. Along the Asiatic coast and between the island groups, there are a number of partially enclosed seas, and these are separated from the great ocean by submarine plateaus of sufficient extent and height to warrant the supposition that a moderate upheaval would extend the Asiatic continent as far south as Australia, transforming the seas into inland salt lakes. Considerations of the peculiar animal and vegetable life of New Zealand and Australia lend probability to the speculation that these islands were joined to the main continent of Asia at some remote period, and it is even possible to trace the submerged coast-line of the great continent which then existed. The same upheaval acting upon the plateau extending out from the Patagonian shore would almost make the Pacific a land-locked ocean, the entrance to it being between the point of the new land stretching out to 121 degrees east latitude and another headland formed by what is now Ducie Island, lying in the same latitude, but about 10 degrees further north. Many of the islands of the various Pacific archipelagos rise from depths of about 3,000 fathoms, forming isolated mountains, springing from the bed of the ocean to a height of 18,000 ft., and several which do not rise to the surface have been detected. More usually a number of islands are bound together by submarine elevations, frequently within a few hundred fathoms of the surface and extending over wide areas. These are the great sierras of the sea.

As has been said, there runs along the American shore a narrow strip of shallow water, but the term "shallow" is to be taken only in a comparative sense. It is from 50 to 200 miles wide, the depth running from nothing to 1,000 fathoms. Outside this again is another strip of not quite so uniform a width, wherein the depth reached 2,000 fathoms, quite deep enough to drown a tall man. The uniform character of the sea's depth is quite marked along the Californian shore, but even here there are ups and downs, shallows and depths. The coast line has a strip of water as its immediate border, in which the depth keeps at about 12 fathoms along a ledge or plateau for a few miles out, and then drops sheer down for 500, 600, and 1,000 fathoms. This shore ledge is quite well defined and generally unbroken, but in it there sometimes occurs a crevasse or valley, whose exploration is a matter of much curious interest. Directly off Point Hueneme, at the entrance to the Santa Barbara channel, there is found a remarkable example of one of these submarine valleys. Commencing with a depth of 10 fathoms 400 yds. from the beach, it increases to 50 fathoms in five-eighths of a mile, and then drops suddenly to 113 fathoms, or 678 ft., in less than 2 miles. Its general direction is south, and it is bounded all round by depths of from 12 to 15 fathoms. These facts are taken from the observations and soundings of Prof. GEORGE DAVIDSON.

Another remarkable example of the submarine valley has been discovered, and to some extent traced out, in Monterey bay by Commodore JAMES ALDEN. The head of this valley is five-eighths of a mile south of Salinas river, and the 20-fathom line is only a quarter of a mile off the beach, the depth increasing to 50 fathoms in the next quarter of a mile. At this distance from shore

the 20-fathom lines are three-eighths of a mile apart. The general direction of the valley for the next 2 miles is southeast, where there is a depth of 117 fathoms, the 50 fathom lines running about five-eighths of a mile apart; thence the valley runs about west, reaching the depth of 170 fathoms in a mile and 240 fathoms in three and one-quarter miles, with 42 fathoms less than a mile to the north. The soundings are not numerous enough to trace its outlines in deep water, but the indications are for 10 miles of its length that it runs southwest, with no bottom at 318 fathoms. It would appear from this description that the valley is really an enormous cañon that opens through the shore-line ledge clear out and down into the deep water of the 1,000 fathom belt.

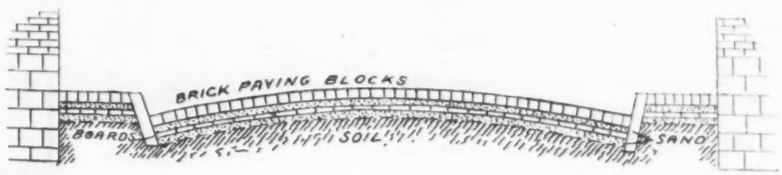
Here again the terms "deep" and "crevasse" are to be taken in the comparative sense. These submarine valleys of the coast-line ledge have their dimensions, it is true, but they sink into utter insignificance beside the abysses which mark the bed of the great ocean—abysses which seem to drop clear to Tophet or Davy Jones's locker. To the east of the Kurlie Islands and Japan there lies a crescent-shaped space of deep water that really merits the term. It extends from 50 degrees north latitude to nearly 20 degrees north latitude or for 1,800 miles, although it is of no great breadth. The average depth of this area is nearly 4,000 fathoms, that is, nearly 24,000 ft. This is deep enough, in all conscience; but along its western margin, and lying like a ditch across the entrance to the Sea of Okhotsk, is an abyss where the United States ship *Tuscarora* found depths of over 4,600 fathoms; that is, of over 27,600 ft., or a hole about deep enough to hold Mount Everest if turned upside down and placed within it.—*San Francisco Chronicle.*

Brick Street Paving.

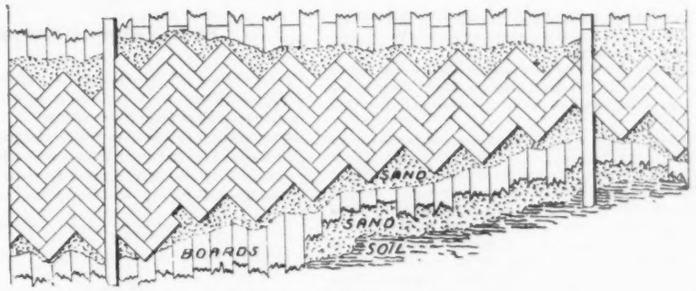
The use of brick for street paving, where travel is comparatively light, and economy is a consideration, is deservedly attracting widespread attention. With brick of proper material and manufacture, hard and homogeneous throughout, this method of street paving has the telling merit of furnishing at a minimum cost, and with the least outlay of skilled labor, a smooth and durable road surface peculiarly well adapted for use in the smaller cities and towns which cannot afford to lay, and do not in fact require, the more expensive if more permanent types of paving.

As showing the simple nature of the work demanded, the accompanying sketches are reproduced from the circular of the Hale Paving Company, of Staunton, W. Va. This company has a patent upon "the combination, in a street pavement, of a shell of hard-burned bricks laid upon a board floor having a bed of sand above and below the floor." As brick laying in sand is too old a practice to be patentable, the rights granted by this patent of 1883 evidently lie in the use of the wooden floor, and this is further proven by the advantages claimed for this floor in furnishing a broader and better base to the brick wearing surface and in preventing settlement and the formation of ruts.

The construction of this pavement is described in the pamphlet referred to as follows: "The grade having been properly reduced and dressed to the required shape, the ground should be covered with a layer of loose sand a few inches in thickness, to form a more perfect bed for the boards to follow, and to keep the boards from contact with the earth beneath to form a sub-drainage, as against the effect of freezing weather. The sand can be struck off to a perfect surface by a moving templet made to suit the desired curve, and guided by slats set to grade-stakes. The boards to be used need not be more than 1 in. in thickness, and ought not to be less than 10 ins. in width, as a rule. The best timber for the purpose is that least subject to rot under the circumstances. Good white-oak has been used successfully. It is deemed best to dip the boards in hot coal-tar; but other preserving material can be used. They are then carefully laid upon the sand bed—lengthwise with the street would be the most convenient way—from curb to curb, with a regular curve all the way. No gutters are necessary except such as are formed by the crown of the pavement. This floor—the broad surfaces of the boards bridging over all minor irregularities of the grading, and so widely distributing all weights or pressure, and being so perfect a barrier from anything solid passing from above or below—now forms a most complete and perfect foundation for the hard material to follow. It is best now to cover the boards with a layer of loose sand 1 in. or 2 ins. in thickness, to form a more perfect bed for the bricks which can be struck off with the moving templet as done before. The use of the moving templet results in a mechanical effect and beauty of outline that is very pleasing to the eye. The bricks—hard-burned—are now laid down. If they are of the ordinary shape of building-bricks now in common use, they should be placed on edge and laid preferably "herring-bone" style, by which means all joints in the board floor are straddled. The seams are now well filled with sand, swept in, and the bricks settled in their beds with a flatter, and well rammed."



Cross-Section.



Plan.

The Hale System of Brick Street Pavement.

Pavements laid in the above manner have stood the test of 14 years' hard service in the streets of Charleston, W. Va. The bricks laid are dry-pressed and hard-burned, and the clay used in their manufacture has been analyzed with the following results:—

Silica	66.30
Alumina	19.53
Iron, Sesquioxide	4.07
Lime	1.87
Magnesia	0.42
Moisture, at 212°	2.08
Combined water	5.16
Undetermined	0.57
	100.00

Mechanical tests, made at the Watertown Arsenal in 1887, show a crushing strength in the Hale bricks tested varying from 4,120 lbs. to 7,038 lbs. per sq. inch. In failing, the bricks flaked off from the sides.

The cost of this particular pavement is not stated; but it is practically an estimate easily figured out, and will depend upon the local value of sand, oak-boards, hard-burned brick, and common labor. The royalty charges are said to be very low. The experience at Charleston, W. Va., leads the company to assert that, under equally good conditions, of well-shaped and compacted roadway, clean sand, and standard brick, this pavement will last in its original condition for not less than 25 years, the wear being even and the surface holding its form.

The New Standards of the Master Car-Builders' Association Proposed for Letter Ballot.

Secretary J. W. CLOUD, of the Master Car Builders' Association, has sent out the circular for letter ballot on the various standards proposed for adoption at the Saratoga Convention. The standards to be voted on are: (1) Journal box lid, (2) Specifications and guarantee for cast-iron wheels, (3) Axle for cars of 60,000 lbs. capacity, (4) Brake gear for air-brake cars, with a brake shoe for iron beam, (5) Buffers and carrier-irons for the M. C. B. type of coupler, and length of draw-bar.

The standards proposed are briefly as follows:

(1) The Fletcher lid, standard width 5 ins., standard length, 7¼ ins.

(3) Standard axle for 60,000-lb. car of the following dimensions:

	Lengths.	*Diameters.*
Journal	8 ins.	4¾ ins.
Wheel fit	7⅛ "	5⅜ "
Collar	⅝ "	5½ "
Dust guard seat	2 "	5¾ "

Lengths c. to c. of journals, 6 ft. 3 ins. Length over all 7 ft. ¼ in. Diameter at center, 4⅝ ins.

(4) Brake gear for air-brake freight cars. The maximum train-pipe pressure to be 70 lbs. The brake power exerted to be 70 per cent. of the light weight of the car. Arrangement of details and foundation gear as shown on drawings. Brake beams to stand a stress of 7,500 lbs. without deflecting more than ⅛ in., and where a stronger beam is required, to stand a stress of 15,000 lbs. with a maximum deflection of ¹ in. The present standard Christy or Collin rubber to be standard where independent brakes and rubbers are used.

(5) Buffers, etc., for the M. C. B. Coupler. Standard draw-bar lengths to be 28 ins. and 30 ins. The latter on all new cars; the other when desired on repairs of cars now in service. Neck of draw bar back of head to be 5 ins. square. Tail end of coupler to be according to drawings submitted. The open space on the carrier-iron to measure 5½ ins. horizontally and 5¾ ins. vertically.

(2) The following are the specifications and guarantee for cast-iron wheels:

SPECIFICATIONS FOR CAST-IRON WHEELS.

1. The chills in which the wheels of any one wheelmaker are cast shall be of equal diameters, and the same chill must not vary at different points more than ⅛ in. in diameter.

2. Wheels of the same nominal diameter furnished by any one wheelmaker must not vary more than ⅛ in. above or below the mean size measured on the circumference, and the same wheel must not vary more than ⅛ in. in diameter. The body of the wheel must be smooth and free from slag, shrinkage, or blow-holes. The tread must be free from deep and irregular wrinkles, slag, chill-cracks, and sweat or beads in throat, which are ⅛ in. or over in diameter, or which occur in clusters of more than 6 ins. in length.

3. The wheels broken must show clean gray iron in the plates; the depth of pure white iron must not exceed ⅜ in. or be less than ⅜ in. in the middle of the tread, and shall not be less than ⅛ in. in the throat. The depth of the white iron shall not vary more than ¼ in. around the tread on the rail line in the same wheel.

4. For each hundred wheels which pass inspection and are ready for shipment, one representative wheel shall be taken at random and subjected to the following test:

The wheel shall be placed flange downward on an anvil block weighing not less than 1,700 lbs., set on rubble masonry at least 2 ft. deep, and having 3 supports not more than 5 ins. wide for the wheel to rest upon. It shall be struck centrally on the hub by a weight of 140 lbs. falling from a height of 12 ft. Should this wheel stand 5 blows without breaking into two or more pieces, the hundred wheels shall be accepted.

The above test shall apply to standard weight wheels from 26 to 42 ins. in diameter, used on the standard gauge roads.

Or, the wheel shall be placed flange downward on a cast iron ring weighing 1,000 lbs. the outside diameter of the ring being 36½ ins., the inside diameter 24 ins., and thick-

ness 8 ins., supported on rubble masonry at least 2 ft deep. It shall be struck on the plate close to the rim, by a weight of 100 lbs. falling from a height of 7 ft. When subjected to this test, a 550-lb. wheel shall stand 20 blows, a 575-lb. wheel, 25 blows; and a 600-lb. wheel, 30 blows, without breaking a piece out. This test applies to 38-in. wheels; 36, 28 and 30-in. wheels must stand the 25-blow test, and 36 and 42-in. wheels must stand the 30-blow test.

5. Should in either case the test wheel break in two or more pieces with less than the required number of blows, then a second wheel shall be taken from the same lot and similarly tested. If the second wheel stands the test, it shall be optional with the inspector whether he shall test a third wheel or not. If he does not so elect, or if he does, and the third wheel stands the test, the hundred; wheels shall be accepted.

6. Wheels shall not vary from the specified weight more than 2 per cent.

7. The flange shall not vary in the same wheel more than 3-32-in. from its mean thickness.

8. All wheels shall be numbered consecutively, and shall have the number, also the day, month, and year when made, plainly formed on the inside plate in casting, and no two wheels shall have the same numbers.

GUARANTEE.

THIS INDENTURE, made this——day of ——18—by and between——party of the first part, and——party of the second part, Witnesseth:

1. The party of the first part hereby agree to furnish to the party of the second part, free on board cars at——chilled cast-iron wheels——ins. in diameter for use under——

2. The party of the second part hereby agrees to pay to the party of the first part——dollars for each wheel furnished, and to keep an accurate record of the mileage made by the wheels placed in service under cars in passenger equipment and under locomotives and tenders, and an accurate record of the number of months of service of the wheels placed in service under cars in freight equipment.

3. The party of the second part hereby agrees, when any wheel furnished under the contract is scrapped, to furnish to the party of the first part a statement which will show:

1. The wheel number.
2. The service in which the wheel ran.
3. The amount of service in months or miles.
4. The cause of failure.

5. A charge against the party of the first part of 55 per cent. of the price of the wheel mentioned above.

6. A credit to the party of the first part of

——cents per 1 000 miles for 36 in., passenger equipment.
—— " " " " " 33 " " "
—— " " " " " 30 " " "
—— " " " " " 36 " loco've & tender equip'nt.
—— " " " " " 33 " " " "
—— " " " " " 30 " " " "
—— " " " " " 28 " " " "
—— " " " " " 28 " " " "
—— " " months " 36 " freight equipment.
—— " " " " 33 " " "
—— " " " " 30 " " "

Except in case of wheels removed for the following causes:

1. Flat by sliding.
2. Chipped flange.
3. Broken flange, if the breakage is not caused by seams, worn through chill or worn flange.
4. Broken or chipped rim, not caused by rim being hollow.
5. Breakage of any kind caused by wreck or derailment.

4. The party of the first part hereby agrees, on presentation of the statement above mentioned, to pay the party of the second part any balance due from lack of sufficient service on the part of the wheels (with above exceptions), to balance the charge, and the party of the second part hereby agrees to pay to the party of the first part any balance due as shown by the aforesaid statement, settlements to be made quarterly.

5. The party of the second part hereby agrees to hold subject to the inspection of the party of the first part, for a period of thirty days after said statement has been rendered, any wheels (with above exceptions) which have not earned for themselves a credit equal to the amount charged against them.

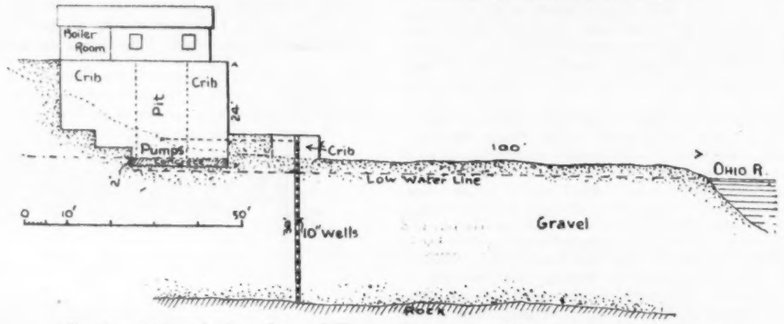
6. It is understood that the basis of settlement shall be as follows:

36-in. passenger wheels ..... 70,000 miles.
33-in. passenger wheels..... 60,000 miles.
36-in. engine and tender wheels..... 60,000 miles.
33-in. engine and tender wheels..... 50,000 miles.
30-in. engine and tender wheels..... 45,000 miles.
28 and 26-in. engine and tender wheels..... 40,000 miles.
Refrigerator, through line and cattle cars. 24 months.
All other freight cars. ..... 48 months.

THE NEW CONGO RAILROAD was voted $2,000,000 on July 23, by the Brussels Chamber of Deputies.

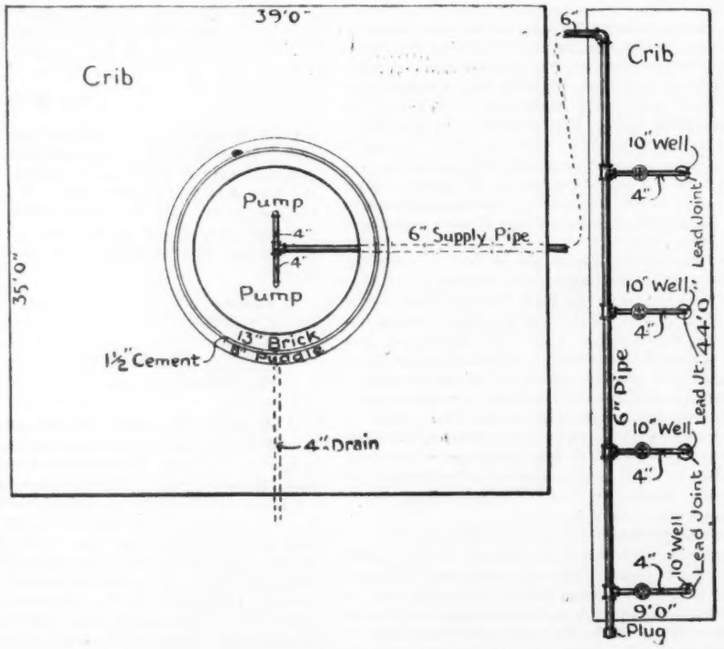
The Supply and Pump Wells of the Sewickley, Pa., Water-Works.

The water supply of Sewickley, Pa., is now drawn from 4 wells, each 10 ins. in diameter, sunk to a depth of 30 ft. in gravel, at a distance of 100 ft. from the Ohio river. The general arrangement of these wells, the pump well, and the connections is shown in the accompanying illustrations.



Section through Supply and Pump-Wells, Sewickley, Pa., Water-Works.

The wells are sunk through the gravel to rock, and have their lower ends covered with brass wire cloth, and fitted with 6-in. sand valves. At the top of each well-casing a lead joint makes a connection between the casing and 4-in. pipes leading to the 6-in. gathering or supply pipe. A tee is placed at the junction of the 4-in. pipes and the well-casing, for use in cleaning out any sand that may accumulate, but it has not been necessary to use these during the 18 months the works have been in operation. The valves permit any number of the wells to be used at once.



Plan of Supply and Pump-Wells, Sewickley, Pa., Water-Works.—JNO. PATTON, JR., *Supt.*

The pump well is 12 ft. in diameter, has a flagstone floor, on concrete, and is surrounded by a large stone crib. There are 2 Worthington pumps, 5¼ by 9¼ ins. The daily yield of the wells is about 300,000 galls. Further details are given in the illustrations.

We are indebted to JNO. PATTON, Jr., Superintendent of the works, for the original sketches and the above data.

ODESSA HARBOR is to be reconstructed by a German firm at a cost of about $5,000,000 under a contract issued at Berlin on July 23.

Ship Canals in 1889.*

The material for this paper has been obtained largely from Harcourt's "Rivers and Canals," from the Annual Reports of the Chief of Engineers, from various scientific and technical publications, and more perhaps than from any other one source, the columns of ENGINEERING NEWS.

Completed ship canals abroad number 12 in all, with a total length of nearly 500 miles, as follows:

The Languedoc canal, known also as the "Canal du Midi," is often spoken of as a ship canal, though its dimensions do not justify such a classification. Its claim to the name seems to be in the fact that it was built for the use of the "ships" of that time (seventeenth century) engaged in the coasting trade between the Atlantic and the Mediterranean shores of France, and that for its time it was undoubtedly as great an undertaking as the Suez canal in recent years.

It forms a communication between Bordeaux and the Bay of Biscay, and Cette and the Mediterranean. Its length is 140 miles, summit level 610 ft. above the Mediterranean, depth 6 ft. 7 ins., and it has 119 locks. The canal was completed in 1681 at a cost of $7,200,000.

The Caledonian canal extends from Inverness Firth on the east coast of Scotland, to Loch Eil on the west coast, a distance of about 60 miles, 38 of which are occupied by a chain of lakes. Early in the century, TELFORD, at the request of the English Government, reported upon the project and was entrusted with the execution of the work, which was

* Abstract of paper read by R. E. PEARY, C. E., U. S. N., at the Seabright Convention of the American Society of Civil Engineering.

commenced in 1804 and completed in 1823. The Government was led to build this canal by the expectation that it would save vessels a long and dangerous circuit by the Pentland Firth, where, previous to the introduction of steam, they were liable to be detained for weeks by contrary winds, and also that in time of war the canal would afford a convenient refuge for merchant vessels from privateers, and a means by which war vessels might pass rapidly from one sea to the other.

The canal was designed for vessels of 20 ft. draft, and it has 28 locks, 170 ft. x 40 ft. x 8 ft. lift. The width on the bottom is 50 ft., on the surface 120 ft., and depth 20 ft. The summit level is 100 ft. above the sea, and the cost of the work was about $5,000,000. It was a bold and skilful undertaking, but it has not been a success financially.

Wars hindered its progress, and finally, to save expense, the summit cut was not carried to full depth, and will permit the passage of vessels of only 17 ft. draft. Had the full depth of 20 ft. been obtained, the canal would have admitted vessels of 1,000 tons, and probably to this fact more than any other may be attributed its failure in a financial sense.

North Holland Canal.—The difficult navigation of the Zuider Zee, formerly the only means of access to the port of Amsterdam, decided the Dutch Government, early in the present century, to make an artificial route for the maritime trade of that city. The shortest line from Amsterdam to the North Sea, in a westerly direction, was then considered out of the question, on account of the difficulty of maintaining an entrance on the exposed flat coast of the North Sea; and a northerly route through North Holland to the Texel Roads was adopted.

The canal built on this route is known as the North Holland, and was commenced in 1819 and finished in 1825 at a cost of $5,000,000. It is 52 miles long, 123½ ft. wide at the surface, 31 ft. wide at the bottom, and 18¼ ft. deep. It has a double-tide lock at each extremity, with chambers 237 ft. x 51 ft. and 82 ft. x 18½ ft., and three regulating locks.

This canal was of great value to Amsterdam, and was of unusual magnitude for the time when it was constructed. It has lost its importance since the completion of the Amsterdam canal.

The Crinan canal, 9 miles long and 12 ft. deep, across the peninsula of Kintyre, enables vessels of 160 tons to save a voyage of about 70 miles round the Mull of Kintyre.

Gloucester Berkeley Canal.—An act was obtained in 1793 for connecting Gloucester by a direct ship canal with the estuary below, and after much delay the canal was completed by TELFORD in 1827. It is 16½ miles long and 18 ft. deep. At the lower end, where it enters the Severn, there is a tide lock.

The Witham canal, which gives Boston a direct communication with the sea, available for vessels of 2,000 tons, is one of the most important of recently completed English works of its class. The canal is 3 miles long and 27 ft. deep, 130 ft. wide on the bottom, and cost, with some accessory works, $1,000,000.

The St. Louis canal was constructed to avoid the bar of the river Rhone. It extends from the Rhone above the bar to the Mediterranean east of the Rhone outlet. It is 2 miles long, 206 ft. wide at low-water level, and 19¼ ft. deep.

The Göta canal gives direct water communication across Sweden from the North sea to Stockholm, a distance of about 300 miles. The canal proper, however, is but a series of short links connecting a chain of lakes which occupy four-fifths of the distance. The canal is 46 ft. wide on the bottom, 86 ft. on the surface, and 10 ft. deep. It has 76 locks and the summit level is 300 ft. above the sea. About 10,000 crafts pass through the canal annually.

Suez Canal.—The value of a channel of communication between the Mediterranean and Red seas, through the Isthmus of Suez, is evident from a glance at a map, saving as it does, a long voyage around the Cape of Good Hope for maritime traffic between Europe and the southern coasts of Asia.

The idea of the construction of such a canal originated in remote antiquity. It is said that a canal across the isthmus existed in the time of SESOSTRIS 1600 B. C., which later was abandoned. NERO and DARIUS both contemplated constructing a canal here, and HARCOURT states that there is evidence that a canal for small vessels was opened and maintained from about 600 B. C. to 800 A. D., but was subsequently allowed to fall into decay.

LOUIS XIV. of France had a proposition submitted to him to construct a canal, and NAPOLEON gave the project very serious consideration, but was deterred from carrying it into execution by the erroneous results of his engineer's surveys, these surveys showing that the level of the Red sea was 10 metres above that of the Mediterranean.

In 1847 these figures were shown to be wrong, and accurate surveys demonstrated that the mean level of the two seas was the same.

In 1854 M. DE LESSEPS obtained the concession for the canal, but the inauguration of the work did not take place until Aug. 25, 1859. Work really began in earnest the following year, and Aug. 15, 1869, the waters of the two seas mingled in the Bitter lakes.

Nov. 17th of the same year the canal was formally opened and traversed by a numerous fleet of vessels of all nations. The canal extends from Port Said on the Mediterranean, at sea level, and without locks, across the Isthmus by the most direct route, which carries it through the depression of lakes Menzallah, Ballah, and Timsah, and the Bitter lakes, to Suez on the Red sea, in a line nearly due north and south. Its length is 99 miles, its width varies at the surface from 196 ft. to 328 ft., according to the strata through which it is excavated, but the bottom width is 72 ft. throughout. The depth is 26 ft. Through a portion of the Bitter lakes, no excavation was necessary, and the deepest cut, at El Guisr, was only 85 ft. to the bottom of the canal. The amount of excavation was about 98,000,000 cu. yds., mostly sand and clay or a mixture of both, except at places south of the Bitter lakes, where some rock was encountered. The cost of the canal was about $100,000,000.

From the day the Suez canal was opened its business increased steadily and rapidly up to 1877, when it amounted to 1,663 vessels annually. In the two following years the traffic decreased, owing to a general depression in trade; then it went up with a jump, more than doubling in amount from 1879 to 1882, and grew rapidly through 1883, when it amounted to 3,307 vessels of a net tonnage of 5,775,861 tons, or say 6,000,000 tons. With this amount of traffic, it became apparent that the capacity of the canal with original dimensions, and only 14 *gares* was practically reached, and it was evident that speedy and simple measures must be taken to increase its capacity.

Two projects were discussed,—one to build a second canal alongside the original one, another to widen and deepen the present canal. The latter project was approved in the beginning of 1885, and the canal is to be enlarged to a depth of 29.5 ft. and a width, 26 ft. below the surface, of from 213 ft. to 246 ft. on tangents, and 246 ft. to 262 ft. on curves of less than 5 mins. radius. The total amount of excavation requisite to complete this enlargement is estimated at 91,000,000 cu. yds. and the estimated cost is about $41,000,000.

The first stage of this work, which will give a depth of 27.8 ft., is now in progress, to cost about $12,000,000. Pending its completion the traffic of the canal since 1883 has increased very slowly, although the canal has been opened to night traffic reducing the time of transit from 36 hours to 16 hours, and the increase has been more in the way of an increased average tonnage per vessel than in the number of vessels. This increase in the average vessel tonnage is very instructive. In 1870 the average was 1,000 tons; in 1886 it was 1,863 tons. With the completion of the enlargement, the traffic of the canal will undoubtedly take another vigorous bound upward.

The financial success of the canal can be best judged by the value of its shares. On ordinary shares the canal paid in 1886 over 11 per cent. and on preferred shares nearly 17 per cent. A year ago ordinary shares of $100 sold in London at $427.50 and in Paris at $434.

Commercially this canal is of more importance to England than to any other country, as it shortens the voyage to her Indian possessions about 7,000 miles, as compared with the voyage around the Cape of Good Hope, and about 75 per cent. of the traffic of the canal is British. Strategically also it is of vital importance to England, and, as events have already shown, in case of complications she will possess and hold it at all hazards.

The Amsterdam canal, which the circuitous route by the North Holland canal, and the increasing size and draught of the vessels trading to Amsterdam, forced that city to construct in order to hold its own against the more favorably situated ports of Rotterdam and Antwerp, extends due west from Amsterdam across the peninsula of Holland to the North sea, a distance of 15¼ miles. Its bottom width is 88½ ft., its surface width 187 ft., and its depth 23 ft. The greater portion of it was constructed through a shallow lake, and the remainder through low sand dunes.

The principal difficulties in its construction were the formation and maintenance of the entrance on the North sea, and the complete rearrangement of the system of drainage of the region traversed by it. This drainage is now pumped into the canal at the North sea, and there is a double lock, as on the North Holland, with chambers 390 ft. x 60 ft. x 227 ft. x 40 ft. At the Zuider Zee end there is a triple lock, with one chamber 315 ft. x 60 ft. and two 238 x47 ft.

In the construction of the canal and harbor 21,000,000 cu. yds. of sand were removed by dredging, much of it costing only 2 *d.* per cu. yd. The canal was commenced in 1865 and completed in 1876, at a total expenditure of nearly $15,000,000.

The canal is doing a large and increasing traffic, as many as 700 vessels having passed through its double locks in one day, to the great benefit of Amsterdam.

The plan for the St. Petersburg canal was matured in 1872-73, but work was not commenced until 1878. It was partially opened in October, 1884, and finally completed and formally opened by the Czar and Czarina, May 27, 1885.

The length of this canal is 18 miles, with a maximum width of 350 ft. and a general width of 180 ft. to 240 ft., depth 22 ft. The cost of the canal was about $9,000,000. The canal starts from the mouth of the Neva, where it opens into a large basin, and after joining the canal to Cronstadt meets the Neva above St. Petersburg. The excavation amounted to about 63,000,000 to 70,000,000 cu. yds. of easily worked material, clay, sand, and gravel, most of it used in construction of the embankments.

The personnel and plant employed upon the canal consisted of 3,500 men, 13 dredgers, 3 locomotives with 230 cars, 86 lighters and barges, 12 tugs, and 7 stationary engines.

This canal has both strategical and commercial importance from opening up communication for war ships and large vessels of all kinds directly with St. Petersburg. Previous to the construction of the canal, the cargoes of all vessels drawing over 9 ft. had to be lightered 20 miles up the river to St. Petersburg, and all goods for export had to be lightered down the river in the same manner. The effect of this canal was to increase the exports of St. Petersburg from 280,000 tons in 1883 to 950,000 tons in 1886, but it was at the expense of Cronstadt, the commerce of which was practically destroyed.

Ghent-Terneuzen Canal.—Beginning as far back as 1251, several canals have been constructed to maintain the communication of Ghent with the sea, the last one having been completed in 1827. The distance from Ghent to the sea by this canal was only 21 miles, as compared with 105 miles by the river Scheldt. It, however, proved inadequate for the constantly increasing size of vessels since its construction, and it has recently been straightened, and enlarged to a width of 173 ft. and a depth of from 20 ft. to 22 ft., with results most beneficial to Ghent.

Completed canals at home are 4 in number, with a total length of about 40 miles.

The Welland canal extends from Lake Erie to Lake Ontario, parallel with and west of the Niagara river. The length is 27 miles, bottom width 100 ft., depth 14 ft. It has 27 locks with a total lift of 330 ft., and will pass vessels of 1,000 tons.

The canal was begun in 1824 and finished by private parties in 1833, the depth being 8 ft. In 1841 it was assumed by the Canadian Government and its enlargement to 9 ft. depth commenced. Still later the depth was increased to 10 ft. by raising the embankments, and the locks were enlarged to correspond. In 1867 the canal was capable of passing a 400-ton vessel, and it had cost up to that time about $7,500,000.

In 1871 it became apparent that it would be necessary to again increase its capacity, and the work of enlargement was commenced soon after and completed in 1887. It was intended at first that this enlargement should consist of an increase in the depth of the canal to 12 ft., and a corresponding in

crease in the rise of the locks; but almost as soon as the work was commenced, it was seen that this would not be sufficient, and the depth was increased to 14 ft. A further enlargement is very likely to be undertaken in the not far distant future.

The St. Mary's Canal, which forms the outlet of Lake Superior, is unique in several respects. It is 1 mile long, has a depth of 16 ft., and has the largest lock in the world, 515 ft. x 80 ft. x 18 ft. lift.

This canal was originally constructed in 1855 with 2 locks, each 350 ft. x 70 ft. x 9 ft. lift. About 1870 it became evident that the capacity of the canal had been nearly reached, and the work of enlargement was undertaken. This consisted of the construction of the present lock and the deepening of the canal to 16 ft.

These improvements were completed in 1881, at a cost of about $2,500,000, with a most astonishing result upon the traffic of the canal.

The number of vessels increased, and their size and draft increased to correspond with the larger water-way. The tonnage of the canal increased from 1,500,000 tons in 1881, the first years of the enlarged canal, to 4,500,000 tons in 1886, i. e., it trebled in 5 years. In 1888 the tonnage was over 5½ million tons. From 1885 to 1886 the total tonnage increased 37 per cent., and from 1887 to 1888 the average tonnage per vessel increased some 20 per cent. The annual tonnage of the canal is now very nearly as great as that of Suez, 1,685 vessels having passed through the canal in one month.

In 1886 it was seen that the capacity of the canal would be reached in two or three years, its ultimate capacity being 96 vessels per day of 24 hours, and 84 having already passed in that time, and a still further enlargement was proposed and is now in progress. This will consist of a lock 800 ft. x 100 ft. with a depth of 21 ft. on the sills and a lift of 18 ft., and the deepening of the canal to 20 ft.

The new lock is to be placed upon the site of the two old ones, and will be used with the present new one. The cost of the enlargement is estimated at $4,738,865, and the time 5 years If, on its completion, the traffic of the canal takes such a bound upward as after the last enlargement—and there is no reason to doubt that it will—Suez, even with its enlargement completed, will have difficult work to keep pace with it.

The present lock in this canal is undoubtedly the finest, as it is the largest, in the world. It is manipulated entirely by hydraulic power furnished by the fall at the lock, and the operation of hauling in, locking, and hauling out a vessel is easily accomplished in 13 minutes. The cost per ton of passing vessels through the canal was in 1882-83, 1½ cts. to 2 cts.; it is now about ½ ct.

The Des Moines canal gives a passage around the Des Moines rapids of the Mississippi river. Its length is 7.6 miles, width 300 ft., depth at extreme low water, 5 ft., and at high water, 16 ft. and 26 ft. The locks are 350 ft. x 80 ft. The total cost of the canal was about $4,500,000. In 1885 about 1,000 vessels passed through this canal.

The Louisville & Portland canal, around the falls of the Ohio, at Louisville, is a work similar to the Des Moines canal. In 1885, 5,000 vessels, of a total tonnage of 1,217,231 tons, passed the canal.

Canals now in process of construction abroad are 3 in number, with a total length of 99 miles.

The Corinth canal will cut the isthmus of the same name, uniting the waters of the Ægean sea and the Gulf of Lepanto. The ancients, PERIANDER, Tyrant of Corinth, in 628 B. C., DEMETRIUS, POLYORCETES, one of the successors of ALEXANDER the Great, CÆSAR, and CALIGULA had all seen the commercial advantages and importance of a canal at this point, and NERO actually undertook the execution of the project, and the evidences of his work after the lapse of 18 centuries, are perfectly distinguishable, and show the measure of the human force that this emperor had at his disposal.

There was a great demonstration at the inauguration of this work, and NERO turned the first sod with a golden spade, in approved modern style. He is said have abandoned the project upon being informed by scientists that the sea was higher on one side of the isthmus than on the other.

In 1881 a French company was organized, with a capital of $6,000,000, M. DE LESSEPS being honorary president. Three routes were surveyed across the isthmus, and the one finally selected was the same as the ancient one of NERO.

May 4, 1882, the work was inaugurated, the King of Greece turning the first sod with a silver spade, and the Queen firing a train of dynamite mines. The line of the canal is perfectly straight, and its total length is 4 miles.

It was expected that the canal could be finished in 4 years, and a contracting firm took the job for $5,280,000; but inaccurate estimates as to the amount and quality of rock to be excavated, the necessity for flattening the side slopes, and the corresponding increase of excavation have greatly prolonged the work and increased the expense.

It is now expected that the canal will be completed in 1890 or 1891. The total cost is variously estimated at from $9,000,000 to $12,000,000.

The canal as completed will be 4 miles long, with a depth of 28 ft., a surface width of about 92 ft., and a bottom width of 52 ft. The depth of the cut at the highest part of the isthmus will be 288 ft.

The personnel and plant employed upon the canal have of course varied with the progress of the work, but at the maximum have been about 3,000 men, 15 locomotives, 700 cars, 6 or 8 dredgers with their attendant tugs and barges. The maximum day's work has been 8,000 c. m.

The total amount of excavation in the canal will be about 8,500,000 c. m., a large portion of which is so-called rock. Up to the end of last year something over 5,000,000 c. m., had been removed. The work on this canal has been especially interesting from the various systems of attacking the great mass of excavation that have been successively tried.

This canal will shorten the voyage of vessels going from the Adriatic sea to Turkey and Asia Minor by 185 miles, and those going through the Straits of Messina by 95 miles. It is estimated that the annual tonnage making use of the canal will be 4,500,000, and the tolls for vessels from the Adriatic will be 20 cts. per ton and those from the Mediterranean, 10 cts.

North Sea & Baltic or Holstein Canal.—Considering the auspices under which it is to be constructed, and the principal incentive to its inception, this canal will probably be the most commanding work of its kind in Europe.

The project for a ship canal between the Baltic and the North sea dates back about 40 years. There are, however, three small canals now in existence between the two seas, one of which was completed in 1398; another was constructed in 1525; and the third, which is 10½ ft. deep, was finished by King CHRISTIAN of Denmark in 1785.

In 1878 the ship canal project was brought forward in a vigorous manner, first by private parties and then by the Government, which gave the entire subject careful legislative consideration during 1881-83, and finally approved the bill in June, 1886. June 3, 1887, the German Emperor officially inaugurated the canal, and only last month proposals for some 15,000,000 cu. yds. of further excavation were advertised for by the Imperial Commission of Kiel.

All the projects for the canal having originated in military and political considerations, the same considerations controlled the selection of the final route from the important naval station of Kiel on the Baltic to Brunsbüttel, the deep water at the mouth of the Elbe, from among some 16 proposed locations. The canal is to be a through cut and its length will be between 60 and 61 miles; the usual radii of curves 4,900 ft. and 6,500 ft. with a minimum of 3,275 ft. The chief value of the canal being in the speed with which it can be traversed, the curves will be as easy and as few as possible.

The deepest cut will be 82 ft. to the water surface. The average cross section of the canal will be 85 ft., 3 ins. wide at bottom, 197 ft. at water surface, and 28 ft. deep, giving 3,930 sq. ft. of prism, which will permit the ordinary Baltic vessels to pass without trouble.

Special sidings and the lakes will accommodate war vessels. The depth will probably be increased to 29½, and future increase in width is provided for. At the North sea end, there will be three tidal locks, 275 ft. x 41 ft., 412 x 82 ft., and 1,180 x 196 ft. respectively, and at the Baltic end a single large lock, all of massive construction and worked by hydraulic power.

The total amount of excavation is 67,000,000 cu. yds. and the estimated cost of the canal $39,000,000. Of this sum, $12,500,000 represents the excess cost of the work as a military canal over what it would cost for purely commercial uses.

The commercial advantages of the canal are the saving in distance, time, pilot dues, and loss in going around Denmark. The saving in distance by vessels running from the south and west of London to the Baltic is 237 miles, and from German ports some 425 miles. The saving in time is from 30 hours for steamers to 4 days for sailing vessels. The greater safety is also an important item, 200 vessels being annually lost in the dangerous passage from the North sea to the Baltic.

The North sea Baltic traffic is variously estimated at from 36,670 to 40,600 vessels annually, with a registered tonnage of 12,240,000 tons, 9,210,000 to 5,500,000 tons of which would use the canal at a toll of 18¾ cts. per registered ton. The great feature of the canal, however, is its military importance, allowing the German fleet to be concentrated either in the North sea or the Baltic.

The Manchester canal, now in process of construction, will make the city of Manchester, at presen 50 miles from the sea, and 35 miles from the head o the tidal estuary of the Mersey, practically a seaport, and will completely alter the destination of an immense amount of tonnage now entered or cleared at London, Hull, and especially Liverpool.

It is said that the scheme for connecting Manchester with the sea dates back to 1712. In 1882 the matter was taken up vigorously by the local authorities and capitalists of Manchester. The first project considered was to deepen and widen the channel, so as to make a tidal waterway from the bar of the Mersey to the Manchester docks, a distance of 50 miles. Thorough surveys and studies led to the rejection of this project and the adoption of the present plan on which the canal is being built, made by Mr. WILLIAMS, C. E.

Opposition from various interests delayed the passage of the canal bill in Parliament for several years, and it was not until the summer of 1887 that this opposition was overcome and the bill finally passed.

The capital of the company was immediately raised and the contract for the construction of the canal given out the same year. Work was commenced at once, and is now being vigorously pushed, so that there seems to be no doubt that the canal will be finished within the contract time of four years, or by Jan. 1, 1892.

The length of the canal is a trifle over 35 miles from Manchester to the Mersey estuary, separated into two divisions.

First, a tidal division extending 12 miles through the Mersey estuary and 8 miles inland, with a bottom width of 100 ft. and a depth of 26 ft. at low tide.

Second, a canal division 15½ miles long, with the same width and depth. There are four locks, or rather series of locks, these locks being built in groups of three, of different sizes, and with intermediate gates, so that any size of vessel may be passed without waste of water. The total rise of the canal is 60 ft.

The total amount of excavation is about 48,000,000 cu. yds. and the contract price for the work is $30,000,000.

The personnel and plant now engaged upon the canal is about as follows, viz.: 15,000 men, 70 steam shovels, 50 steam cranes, 150 locomotives, 5,000 dump cars, etc., and an average of over 1,000,000 cu. yds. per month are being taken out.

The figures of the expected traffic of the canal I am unable to give, but there seems to be no question that it will be a financial as well as an engineering success, there being a very dense manufacturing population within a radius of a few miles of Manchester, to which supplies must be brought, and from which manufactured products must be taken away.

(TO BE CONTINUED.)

THE RAINFALL IN NEW YORK, for July, amounted to 9.52 ins. for the month as recorded at the signal service station. This has been only twice exceeded in the history of the Weather Bureau,—in August 1875, when 10.42 ins. fell and in September 1882, when the total was 14.51 ins. The heaviest rainfall recorded in New York for any 24 hours was in September 23 and 24, 1882, when the gauge showed 6.17 ins.

The Pœtsch Freezing Process as Applied at the Chapin Iron Mine.

At various times notices have appeared in this journal concerning the freezing process for sinking shafts and making excavations in quicksand, etc. We have now to record the completion of the first work done in this way in America, namely a shaft sunk for the Chapin Mining Company at Iron Mountain, Michigan.

The owners of the American patents, the Pœtsch-Sooysmith Freezing Co. of this city, contracted to freeze, excavate, and curb up a rectangular shaft 15½ x 16½ ft. and about 100 ft. deep to the ledge. The mining company put the freezing pipes into the ground 3 ft. apart, in a circle 29 ft. in diameter, and, with the exception of two of the pipes, to the ledge. This proved to be a difficult task on account of the many boulders encountered. A 10-in. casing pipe with flush joints was first drilled down by various means, a drill being worked within the pipe when necessary and the material removed by jetting or by a sand pump. The casing pipe being once down to the ledge, a freezing pipe was placed inside, and the outer casing pipe drawn up and used for the next pipe. The freezing pipes left in the ground were 8 ins. in diameter, the lower ends being closed.

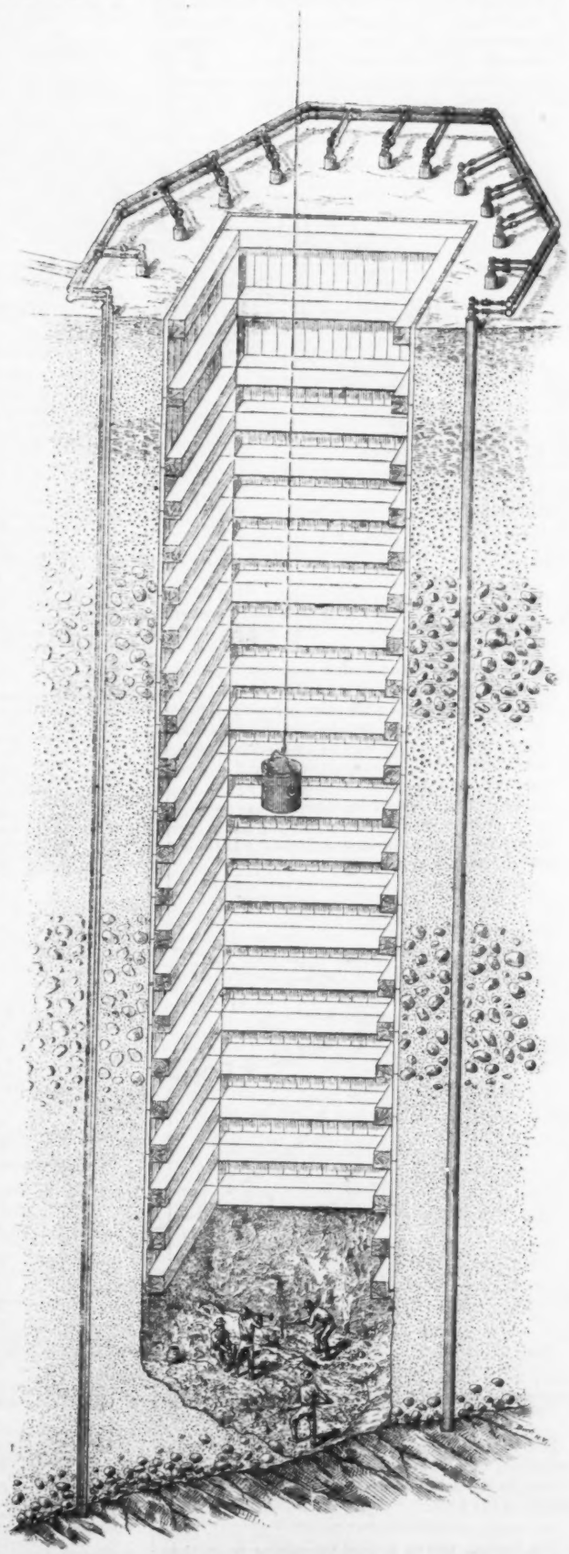
Inside of these 8-in. pipes were placed pipes 1¼ ins. in diameter, open at the bottom. These inner pipes, as well as the outer pipes, were connected together at the top of the ground, as shown in the illustration, forming a complete circuit, through which a cold brine was circulated.

The brine used was a solution containing about 25 per cent. of calcium chloride, which has a very low freezing point. The brine was cooled with a Linde ice machine, made by F. W. WOLF, of Chicago, having a refrigerating capacity of 50 tons of ice per day. The ammonia was compressed to about 135 lbs. per sq. in., and cooled by passing through coils immersed in water kept cold by pumping from a brook. Then the ammonia was allowed to expand through coils immersed in the brine and finally returned to the compressor.

The temperature of the expanded ammonia was such as to cool the brine to a few degrees below zero, Fahrenheit. This brine, being circulated through the ground pipes, was raised in temperature about 2° Fahr. After 40 days, freezing an ice wall 10 ft. thick was formed around the shaft. The excavation commenced soon after starting: the ice machine had, in the meantime, reached a depth of 40 ft. Thirty days more sufficed to reach the ledge.

The shaft was, for convenience, curbed as the excavation proceeded. This was, however, not necessary, as the walls would have stood vertically throughout the whole depth very well. The temperature of the air within the shaft was generally below the freezing point, and there was no indication of the exposed material thawing. The curbing was made of horizontal sets of timbers, 16 ins. square, placed 2 ft. apart, with 4-in. vertical plank behind the timbers. The cross walls were placed in afterwards.

The timbering was supported from one set to another by bolts placed near the corners of the shaft, the whole system being suspended from cross timbers at the surface of the ground. The unfrozen



The Freezing Process in Shaft Sinking, as applied at the Chapin Mine, Mich., by the Pœtsch-Sooysmith Freezing Company.

area within the shaft grew less as the actual running time of the freezing machine increased. By the time a stratum of boulders was encountered, the frozen area reached nearly across the shaft; but when quicksand containing a large percentage of water was passed through, the unfrozen area was greater. The reason of this is readily understood when it is remembered that the specific heat of water is about five times as great as that of any of the other materials, and therefore the strata containing most water would require more cold and would be longer in freezing.

The hardness and appearance of the fractures of the frozen quicksand approached those of sandstone. Granite boulders embedded in it showed a decided tendency to fracture across rather than break loose. The tensile strength of the frozen ground, as determined by a cement testing machine, was equal to that of the best neat Portland cement, and varied from 350 to 450 lbs. per sq. in.; and its strength against crushing, as determined from inch square cubes, was 850 lbs. per square inch.

This furnishes data from which the strength of the surrounding frozen wall may be computed as an arch. An ice wall 10-ft. thick will be found sufficiently strong for any case likely to occur. Near the bottom the freezing extended within the circle solidly 10 ft. from the pipes. It is not known how far it extended outside, as no borings could be made through it. A test pit was sunk outside the shaft as far as the water would permit (some 15 ft.), and from this it appeared that the freezing extended outwardly from the pipes about three fourths as far as within the circle.

The material was mostly loosened by picks and chisel bars. Black powder was used for blasting for a considerable time, but this was discontinued for fear the concussion might injure the pipes or fracture the wall. The material was hoisted out by an iron bucket, which also took out the water which stood in the unfrozen centre. There was no appreciable inflow of water until the excavation had reached nearly to the ledge, when a small amount was noticed.

On reaching the ledge, it was discovered that it was so fissured and disintegrated as to allow water to come in under the frozen wall at a corner in the vicinity of one of the pipes that did not extend to the ledge. On Feb. 30 the incoming stream had so worn a channel as to permit a jet of sand and water 3 ins. in diameter to enter.

The shaft was allowed to flood, water being pumped into it at the same time to prevent as much as possible the flow of water through the opening.

An 8-in. freezing pipe was put in place in the shaft, the foot being directly at the opening, and earth was piled around it, the purpose being to freeze the leak off.

Cold brine was circulated through the whole system of freezing pipes for 10 days uninterruptedly, when the water was pumped out, and the seam was found to be quite closed; but there was still a small amount of percolation through the ledge, requiring occasional pumping to clear the shaft; ice had collected several inches thick on the side shaft and several feet in the corner, where the extra freezing pipe was placed.

The work of removing the earth which had been thrown in and the clearing up of the bottom continued for two weeks, when the water from the ledge increased at such a rate that it was decided to lay short auxiliary freezing pipes against the leaks and freeze the ledge itself. This was done, the shaft was flooded again, and the brine circulated 30 days. When the water was pumped out, the leakage was found to be small, and excavation was proceeded with. The soft, shaly rock was removed till a hard bearing was obtained for the timbers, and the timbering was completed from the surface of the ground to the excavated depth.

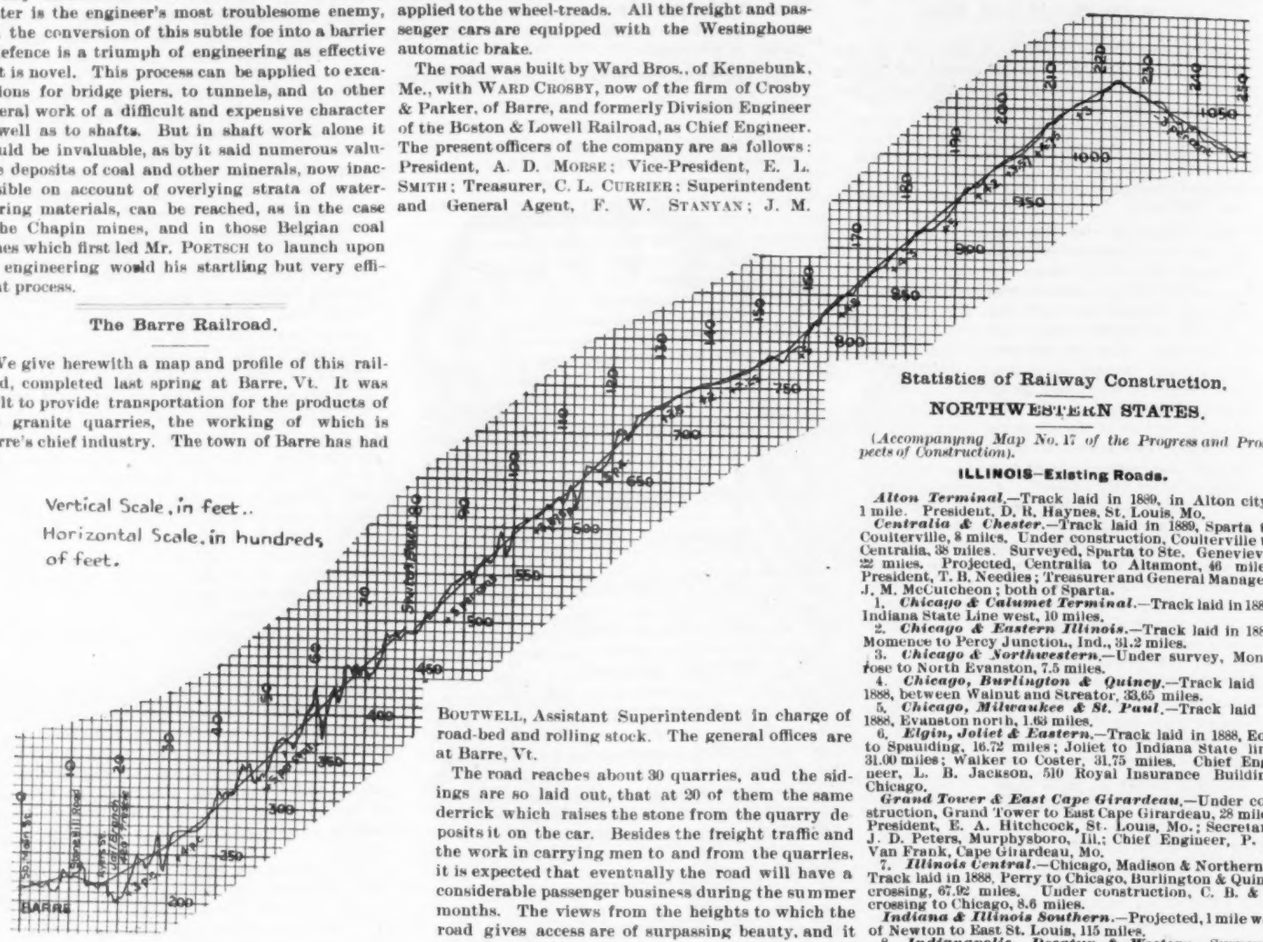
The obvious remedy for inflow from the rock will be in the future to put the pipes far enough into the ledge to freeze off the surface seams. The Freezing Co. is now putting down pipes for a coal mining shaft at Wyoming, Pa., and will put them several feet into the rock, which will no doubt intercept all troublesome percolation.

Engineers have been watching the introduction of the Pœtsch process into this county for some time, and will doubtless be interested in its successful application at the Chapin mine, the first application

on any considerable scale in the United States Water is the engineer's most troublesome enemy, and the conversion of this subtle foe into a barrier of defence is a triumph of engineering as effective as it is novel. This process can be applied to excavations for bridge piers, to tunnels, and to other general work of a difficult and expensive character as well as to shafts. But in shaft work alone it should be invaluable, as by it said numerous valuable deposits of coal and other minerals, now inaccessible on account of overlying strata of water-bearing materials, can be reached, as in the case of the Chapin mines, and in those Belgian coal mines which first led Mr. POETSCH to launch upon the engineering world his startling but very efficient process.

The Barre Railroad.

We give herewith a map and profile of this railroad, completed last spring at Barre, Vt. It was built to provide transportation for the products of the granite quarries, the working of which is Barre's chief industry. The town of Barre has had through the development of these quarries a very healthy boom, at least for a place in New England. Its population in 1880 was 2,080. It is now between 6,000 and 7,000. The quarries are mostly located on Mill-Stone hill, lying about 4 miles south of Barre and at an elevation of about 1,000 ft. above it.



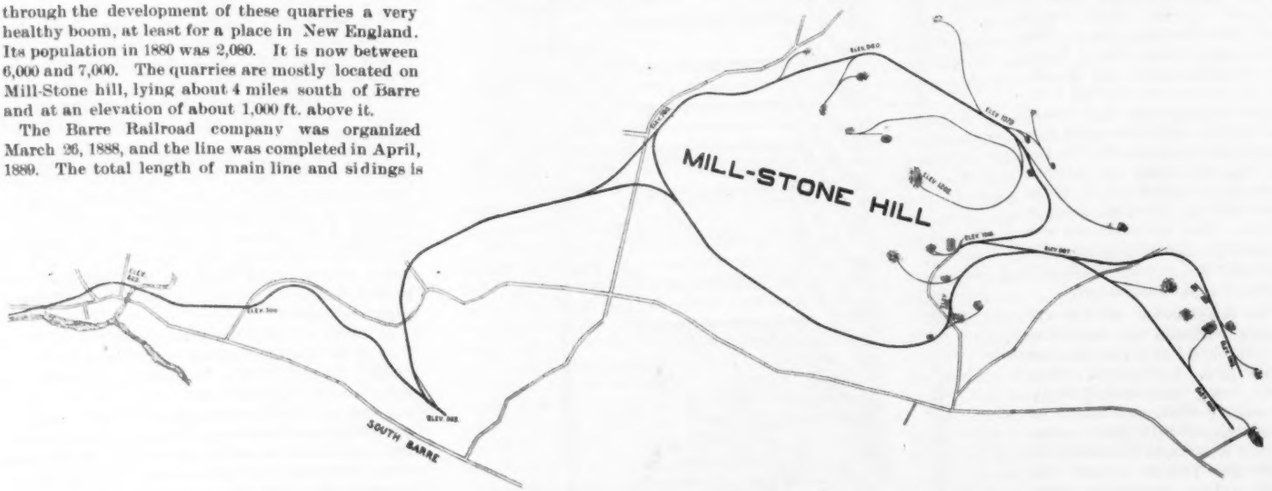
Profile of Barre Railway.

The Barre Railroad company was organized March 26, 1888, and the line was completed in April, 1889. The total length of main line and sidings is 13¼ miles. The main line has one switchback. The maximum grade is 264 ft. per mile and the road rises 875 ft. in a little less than 4 miles. Some of the sidings have 20° curves. The road is standard gauge and substantially built and is laid with 60-lb. steel rails.

The locomotives used were built by the Baldwin Locomotive Works, and have 4 and 6 drivers. They are equipped with Westinghouse and Le Chatelier brakes. The latter, which works by using the cylinders as air-compressors, is used in running down the long hill, and avoids the heating and wear of tires that takes place with the usual form of brake applied to the wheel-treads. All the freight and passenger cars are equipped with the Westinghouse automatic brake.

The road was built by Ward Bros., of Kennebunk, Me., with WARD CROSBY, now of the firm of Crosby & Parker, of Barre, and formerly Division Engineer of the Boston & Lowell Railroad, as Chief Engineer. The present officers of the company are as follows: President, A. D. MORSE; Vice-President, E. L. SMITH; Treasurer, C. L. CURRIER; Superintendent and General Agent, F. W. STANYAN; J. M. BOUTWELL, Assistant Superintendent in charge of road-bed and rolling stock. The general offices are at Barre, Vt.

The road reaches about 30 quarries, and the sidings are so laid out, that at 20 of them the same derrick which raises the stone from the quarry deposits it on the car. Besides the freight traffic and the work in carrying men to and from the quarries, it is expected that eventually the road will have a considerable passenger business during the summer months. The views from the heights to which the road gives access are of surpassing beauty, and it is expected that several summer hotels will be erected on Mill-Stone hill.



Map of the Barre Railroad. Scale: 1 inch = ½ mile. WARD CROSBY, *Chief Engineer.*

For the above facts, and for the use of the drawings from which our cuts are reproduced, we are indebted to the courtesy of WARD CROSBY, Chief Engineer of the road.

THE EIFFEL TOWER is said to average more than $5,000 per day in receipts. On any one of the full-priced days more than 20,000 people have paid admission, and including the additional fee for using the elevators the receipts reach $10,000 per day. The tower cost $1,000,000, and it is expected that it will be half paid for by the time the Exhibition closes.

Statistics of Railway Construction.

NORTHWESTERN STATES.

(Accompanying Map No. 17 of the Progress and Prospects of Construction).

ILLINOIS—Existing Roads.

Alton Terminal.—Track laid in 1889, in Alton city, 1 mile. President, D. R. Haynes, St. Louis, Mo.

Centralia & Chester.—Track laid in 1889, Sparta to Coulterville, 8 miles. Under construction, Coulterville to Centralia, 38 miles. Surveyed, Sparta to Ste. Genevieve, 22 miles. Projected, Centralia to Altamont, 46 miles. President, T. B. Needles; Treasurer and General Manager, J. M. McCutcheon; both of Sparta.

1. ***Chicago & Calumet Terminal.***—Track laid in 1888, Indiana State Line west, 10 miles.
2. ***Chicago & Eastern Illinois.***—Track laid in 1888, Momence to Percy Junction, Ind., 31.2 miles.
3. ***Chicago & Northwestern.***—Under survey, Montrose to North Evanston, 7.5 miles.
4. ***Chicago, Burlington & Quincy.***—Track laid in 1888, between Walnut and Streator, 33.65 miles.
5. ***Chicago, Milwaukee & St. Paul.***—Track laid in 1888, Evanston north, 1.63 miles.
6. ***Elgin, Joliet & Eastern.***—Track laid in 1888, Eola to Spaulding, 16.72 miles; Joliet to Indiana State line, 31.00 miles; Walker to Coster, 31.75 miles. Chief Engineer, L. B. Jackson, 510 Royal Insurance Building, Chicago.

Grand Tower & East Cape Girardeau.—Under construction, Grand Tower to East Cape Girardeau, 28 miles. President, E. A. Hitchcock, St. Louis, Mo.; Secretary, J. D. Peters, Murphysboro, Ill.; Chief Engineer, P. R. Van Frank, Cape Girardeau, Mo.

7. ***Illinois Central.***—Chicago, Madison & Northern.—Track laid in 1888, Perry to Chicago, Burlington & Quincy crossing, 67.92 miles. Under construction, C. B. & Q. crossing to Chicago, 8.6 miles.

Indiana & Illinois Southern.—Projected, 1 mile west of Newton to East St. Louis, 115 miles.

8. ***Indianapolis, Decatur & Western.***—Surveyed, Decatur to Beardstown, 81.7 miles.

Kaskaskia, St. Elmo & Southern.—Located, Altamont to Metropolis, 158 miles. President, B. F. Johnston, St. Elmo; Chief Engineer, James M. Brown.

9. ***Lake Erie & Western.***—Bloomington & Peoria extension.—Track laid in 1888, Station No. 900 to Station No. 1,715, 15.43 miles.

Louisville, Evansville & St. Louis.—Under construction, Belleville to Mt. Vernon, 67 miles.

10. ***Pawnee.***—Track laid in 1889, Pawnee to St. Louis & Chicago Junction, 5 miles. Projected, St. Louis & Chicago Junction to Roodhouse, 35 miles; Pawnee to Sullivan, 55 miles. Secretary, C. E. Clayton, Pawnee.

11. ***St. Louis, Alton & Springfield.***—Track laid in 1888, Newbern to Alton, 13.4 miles. Under construction, Bates to Springfield, 14 miles.

St. Louis, Alton & Terre Haute.—Track laid in 1888, Parker City to Brooklyn, 38 miles.

St. Louis & Chicago.—Under construction, Mt. Olive to Alhambra, 14 miles.

Projects and Surveys.

Belleville & St. Louis.—Located, Belleville to East St. Louis, 8 miles. President, John S. Hill, East St. Louis; Chief Engineer, Louis Graner, Belleville.

Cairo & Northwestern.—Surveyed, Cairo to East Cape Girardeau, 40 miles. President, Chas. O. Patier, Cairo; Chief Engineer, Geo. W. Morse; Secretary, H. Wells, Cairo.

Chicago & New Orleans.—Projected, Shumway to Paducah, 152 miles. President, Geo. A. Sanders; Chief Engineer, Chas. Hansel; both of Springfield.

12. ***Danville, Chicago, & Northwestern.***—Projected, Tilton to Strawn, 85 miles. President, John McNulta; Chief Engineer, Charles Hansel, Springfield.

13. ***Indianapolis, Beardstown & Quincy.***—Projected, Beardstown to Quincy, 50 miles. F. B. Stearns, New York City.

14. ***Pana & Roodhouse.***—Surveyed, Pana to Roodhouse, 70 miles. President, J. E. Essick, Pana.

15. ***Paxton & Eastern.***—Projected, Paxton to Indiana State Line, 40 miles. Chas. Bozardus, Springfield.

16. ***Peoria, Springfield & St. Louis.***—Projected, Springfield to East St. Louis, 87 miles. President, W. S. Hook, Jacksonville.

17. ***Springfield & Southern Illinois.***—Projected, Springfield to Pinckneyville, 125 miles. President, Rufus N. Ramsay, Carlyle, Ill. Secretary, Amos Miller, Hillsboro, Ill.

18. ***Waukegan & Southwestern.***—Projected, Waukegan to Hanover, 30 miles. Chas. S. Holt, Lake Forest.

Total.—Track laid in 1888, 273 miles. Track laid in 1889, 14 miles. In process of construction, 109 miles. Under survey, 387 miles. Projects of some promise, 874 miles.

WISCONSIN.—Existing Roads.

19. ***Abbottsford & Northeastern.***—Under construction, Abbottsford to Black Creek Falls, 15 miles. Under survey, Black creek Falls to Merrill, 20 miles; branch to Warsaw, 15 miles. Chief Engineer, Linton Williams, Black Creek Falls.

3. ***Chicago & Northwestern.***—Track laid in 1888, Lake Geneva to Williams Bay, 6 miles.

5. ***Chicago, Milwaukee & St. Paul.***—Track laid in 1888, Alva to Withee, 2.38 miles; Lapham Junction to Zeda, 2.66 miles.

20. ***Duluth, South Shore & Atlantic.***—Track laid in 1888, 125 miles west of Nestoria to Iron River Junction, 40.83 miles; West Superior extension, 3.75 miles.

21. ***Goodyear, Neillsville & Northern.***—Track laid in 1888, Goodyear north 5 miles. Under survey, 5 mile post to Neillsville, 30 miles. President, D. A. Goodyear, Tomah.

7. ***Illinois Central.***—Freeport, Dodgeville & Northern. Track laid in 1888, Argyle to Dodgeville, 28.56 miles.

22. ***Milwaukee, Lake Shore & Western.***—Track laid in 1888, Rhinelander to Flambeau, 27 miles; Hurley south, 5 miles; Pience branch extended, 2.6 miles; Ontonagon river branch, 1.7 miles; Wolf & Wisconsin River R. R. to Harrison and Parish, 13.1 miles. Under construction, Flambeau to Hurley, 41 miles. Projected, Aniwa east, 12 miles.

24. ***St. Paul, Minneapolis & Manitoba.***—Eastern Minnesota.—Track laid in 1888, Minnesota State line to West Superior, 29 miles.

24. ***Sault Ste. Marie & Southwestern.***—Under construction, Osseo to Mondovi, 23 miles. Projected, Rhinelander to Fairchild, 115 miles; Mondovi to Alma, 30 miles.

Projects and Surveys.

25. ***Black River Falls & Eastern.***—Surveyed, Black River Falls to Green Bay, Winona, & St. Paul R. R., 23 miles. President, Hugh H. Price, Black River Falls; Chief Engineer, A. S. Cooper.

26. ***Eau Claire, Mississippi & Lake Superior.***—Surveyed, Eau Claire to Winona, 66 miles. Projected, Eau Claire to Ashland, 190 miles. President, R. F. Wilson; Chief Engineer, C. E. Bussell; both of Eau Claire.

27. ***Escanaba, Twin City & Western.***—Projected, Escanaba to Chippewa Falls, 240 miles. President, Marcus Pollasky, Escanaba; Treasurer, Fred. F. Day, Milwaukee.

28. ***Kickapoo Valley & Northern.***—Under survey, Woodman to Tomah, 80 miles. Chief Engineer, Jas. Appiebee; Vice-President, B. F. Washburn, Excelsior.

29. ***Wisconsin Midland.***—Located, Kaukauna to Sturgeon bay, 72 miles; Fond du Lac to Madison, 69 miles. Surveyed, Fond du Lac to Michigan State line, 156 miles; Oconomowoc to Fond du Lac, 52 miles. Projected, Oconomowoc to Chicago, 96 miles; Wisconsin State line to L'Anse, 68 miles. President, C. H. Benton; Chief Engineer, N. Boardman; Secretary, Dana C. Lamb; all of Fond du Lac.

Total.—Track laid in 1888, 163 miles. Track laid in 1889, 5 miles. In process of construction, 79 miles. Under survey, 573 miles. Projects of some promise 687 miles.

MICHIGAN.—Existing Roads.

(*Lines within limits of map only.*)

20. ***Duluth, South Shore & Atlantic.***—Track laid in 1888, Bessemer branch, 10 miles.

30. ***Milwaukee & Northern.***—Under construction, Adventure creek to Duluth, South Shore & Atlantic R. R., 26 miles.

Projects and Surveys.

31. ***Northern Michigan.***—Projected, Houghton to Watersmeet, 70 miles. Vice-President and General Manager, C. O. Wright, Hancock; Chief Engineer, Chas. S. Robinson, Hancock.

MANITOBA and NORTHWESTERN PROVINCES.

Existing Roads.

Canadian Pacific.—Under construction, Brandon to Souris Coal Fields, 100 miles; Glenboro to Pium creek, 25 miles. Under contract, Long Lake to Saskatchewan, 150 miles. Projected, Barnsley to Boyne, 55 miles.

Great Northwest Central.—Under construction, Brandon north, 50 miles. Projected, 50 mile post to Battleford, 400 miles. Chief Engineer, J. H. E. Secretan, Brandon, Manitoba; Secretary, E. A. Allan, Ottawa, Ont.

Manitoba & Northwestern.—Track laid in 1888, Langenburg to Saltcoats, 26 miles. Surveyed, Saltcoats to Prince Albert, 243 miles. Projected, Rapid City to east bank of Assiniboine river, 50 miles.

Northern Pacific & Manitoba.—Track laid in 1888, Winnipeg to West Lynne, 66 miles; track laid in 1889, Winnipeg to Portage La Prairie, 52 miles. Under construction, Morris to 100-mile post, 100 miles. Under survey, 100-mile post to Brandon, 40 miles. Projected, Brandon to Souris, 150 miles. J. M. Graham, Winnipeg, General Manager.

Projects and Surveys.

32. ***Duluth, Rainy Lake River & Southwestern.***—Under survey, Duluth to Winnipeg, 125 miles. Chief Engineer, W. B. Banks, Superior, Minn.

Great Northwestern Railway of Canada.—Projected, Calgary to Edmonton, 450 miles. C. S. Drummond, Winnipeg, Man.

Northwestern Junction & Lake of the Woods.—Projected, Portage La Prairie to Lake of the Woods, 175 miles. Alex. Mutchinor, 104 Sparks St., Ottawa, Ont.

33. ***Port Arthur, Duluth & Western.***—Located, Port Arthur to International boundary, 85 miles. President, Thomas Marks; Chief Engineer, Henry K. Wicksteed; both of Port Arthur, Ont.

Winnipeg Transfer.—Located, belt line at Winnipeg, 1 mile. President, G. R. Crowe, Winnipeg.

MINNESOTA—Existing Roads.

34. ***Chicago, St. Paul & Kansas City.***—Track laid in 1889, Eden to Wasioja, 4 miles.

35. ***Duluth & Iron Range.***—Track laid in 1888, Tower to Ely, 21 miles.

36. ***Duluth & Winnipeg.***—Track laid in 1888, Cloquet north, 20 miles. Projected, end of track to Grand Rapids, 45 miles. President, R. S. Munger, Duluth; General Manager, W. H. Fisher, St. Paul.

37. ***Duluth, Red Wing & Southern.***—Track laid in 1888, Red Wing to Goodhue, 16 miles; track laid in 1889, Goodhue to Zumbrota, 9 miles. Projected, Zumbrota to Albert Lea, 57 miles; Red Wing to Duluth, 150 miles. President, F. W. Hoyt; Chief Engineer, Wm. Danforth, both of Red Wing, Minn.

38. ***Minneapolis, St. Paul & Sault Ste. Marie.***—Track laid in 1888, Cardigan Junction to St. Paul, 5.4 miles.

39. ***Northern Pacific.***—Under construction, Little Falls to Staples, 33 miles.

23. ***St. Paul, Minneapolis & Manitoba.***—Track laid in 1888, Wilmar to Dakota State Line, 116.9 miles Crookston to Fosston, 44.7 miles; Hinckley to Wisconsin State Line, 39.4 miles. Projected, Fosston to Milaca, 175 miles.

40. ***West Duluth Incline.***—Track laid in 1889, in Duluth, 3 miles.

41. ***Winona & Southwestern.***—Track laid in 1888, Winona to Bear Creek Station, 20.15 miles. Surveyed, Bear Creek Station to Mason City, Ia., 117 miles. President, Hon. William Windom; Chief Engineer, D. M. Wheeler, Winona; Vice-President, H. W. Lamberton, Winona.

Projects and Surveys.

42. ***Duluth, Crookston & Northern.***—Projected, Duluth to Crookston, 230 miles. President, R. J. Montague; Chief Engineer, E. W. Lewis, Crookston.

43. ***Minnesota Northern.***—Projected, Worthington to Appleton, 100 miles. President, C. H. Smith, Worthington; Chief Engineer, B. F. Woolstencroft, Fulda.

44. ***St. Paul, New Ulm & Southwestern.***—Projected, Hopkins to Lakefield, 125 miles. President, W. C. Bredenhagen, Carver.

Total.—Track laid in 1888, 284 miles. Track laid in 1889, 16 miles. In process of construction, 55 miles. Under survey, 160 miles. Projects of some promise, 984 miles.

DAKOTA—Existing Roads.

3. ***Chicago & Northwestern.***—Projected, Pierre to Cheyenne river, 120 miles.

45. ***Deadwood Central.***—Track laid in 1888, Deadwood to Lead City, 3.3 miles. Projected, Lead City to Ruby Mines, 15 miles. President, Jas. K. Miller; Chief Engineer, A. D. Wilson; both of Deadwood.

38. ***Minneapolis, St. Paul & Sault Ste. Marie.***—Partly graded, Aberdeen to Bismarck, 104 miles. Surveyed, Boynton to Ashley, 35 miles.

39. ***Northern Pacific.***—Under construction, Minnewaukon to Leeds, 18 miles.

23. ***St. Paul, Minneapolis & Manitoba.***—Track laid in 1888, Minnesota State Line to Sioux Falls, 30 miles; Church's Ferry to St. Johns, 55 miles. Projected, Sioux Falls to Yankton, 60 miles.

Projects and Surveys.

46. ***Columbia & Northwestern.***—Projected, Columbia to Milnor, 60 miles. President, John D. Lavin; Chief Engineer, S. H. Hildebrand; Secretary, G. M. Lyon; all of Columbia.

47. ***Duluth, Milbank, Huron & Chamberlain.***—Projected, Morris, Minn., to Chamberlain, 210 miles President, D. W. Diggs; Secretary, Irving Balch; both of Milbank.

48. ***Forest City & Southeastern.***—Surveyed Forest City to Gettysburg, 10 miles. President, Gov. M. G. Bulkley; Secretary, J. J. S. Hasser, Forest City.

49. ***Hermosa, Hill City & Western.***—Projected, Hermosa to Wyoming State Line, with branch to Custer City., 80 miles. President, Milton R. Masson; Chief Engineer, Alvin S. Way; Secretary, C. J. Patten; all of Hermosa.

50. ***Milbank, Egan & Sioux City.***—Projected, Milbank to Egan, 75 miles. President, Wm. M. Brooks, Brookings; Secretary, D. W. Diggs, Milbank.

Total.—Track laid in 1888, 118 miles. In process of construction, 202 miles. Under survey, 45 miles. Projects of some promise, 565 miles.

NEBRASKA.—Existing Roads.

3. ***Chicago & Northwestern.***—Chicago, St. Paul, Minneapolis & Omaha.—Surveyed, Hartington to Yankton, Dak., 24 miles; Fremont, Elkhorn & Missouri Valley R. R.—Track laid in 1888, Geneva to Superior, 45.3 miles; Creighton to Verdigris, 12.3 miles. Projected, Verdigris to Niobrara, 12 miles.

4. ***Chicago, Burlington & Quincy.***—Burlington & Missouri River R. R.—Track laid in 1888, Grand Island to Missouri line, 19.6 miles; Central City northwest, 1.47 miles; Nebraska City to Nebraska City Junction, 8.85 miles. Track laid in 1889, Alliance north, 35 miles. Under construction, end of track to Wyoming coal fields, 125 miles.

51. ***Chicago, Rock Island & Pacific.***—Projected, Omaha to Fairbury, 110 miles.

52. ***Kansas City, Wyandotte & Northwestern.***—Projected, Summerfield to Beatrice, 35 miles.

53. ***Missouri Pacific.***—Track laid in 1888, between Warwick and Prosser, 48 miles; Talmage to Crete, 58 miles.

54. ***Pacific Short Line.***—Under construction, Sioux City west, 100 miles. Under survey, 100 mile post to Ogden City, Utah, 800 miles. President, Millard R. Jones, New York City; Chief Engineer, L. H. Clarke, Sioux City, Iowa; General Manager, Donald McLean, Sioux City.

55. ***Yankton, Norfolk & Southwestern.***—Under contract, Yankton, Dak., to Norfolk, Neb., 70 miles. President, James H. Teller; Chief Engineer, D. C. Rice; both of Yankton, Dak.

Projects and Surveys.

56. ***Broken Bow & Western.***—Projected, Arcadia to North Platte, 85 miles. President, John C. Maulick; Chief Engineer, J. W. Mathews; Gen. Manager, Jesse Gandy; all of Broken Bow.

57. ***Missouri River, North Platte & Denver.***—Projected, Albion to Arcadia, 60 miles. President, Loran Clark; Chief Engineer, J. W. Andrews; both of Albion.

Total.—Track laid in 1888, 194 miles. Track laid in 1889, 35 miles. In process of construction 215 miles. Under survey, 324 miles. Projects of some promise, 347 miles.

IOWA.—Existing Roads.

5. ***Chicago, Milwaukee & St. Paul.***—Track laid in 1888, Maquoketa to Hurstville, 2.34 miles.

58. ***Davenport, Iowa & Dakota.***—Track laid in 1888, Davenport to Burlington, Cedar Rapids & Northern R.R., 21 miles. Under construction, end of track to Anamosa, 35 miles. Projected, Anamosa to Independence, 42 miles. Chief Engineer, A. L. Stannard, Davenport.

59. ***Des Moines Belt Line.***—Track laid in 1888, Des Moines to Highland Park, 4 miles.

60. ***Sioux City & Northern.***—Under construction, Sioux City to Flandreau, Dak., 120 miles. President, John Harwick; Chief Engineer, L. F. Wakefield; both of Sioux City.

Projects and Surveys.

61. ***St. Louis, Quincy, Omaha & Sioux City.***—Projected, Trenton, Mo., to Council Bluffs, 165 miles. President, F. B. Stearns, New York City; Treasurer, Theodore Weed, 30 Vesey St., New York City.

62. ***Tabor & Northern.***—Surveyed, Tabor to Hillsdale 8 miles. President, T. McClelland; Secretary, A. T. West; both of Tabor.

Total.—Track laid in 1888, 37 miles. In process of construction, 113 miles; Under survey, 8 miles; Projects of some promise, 322 miles.

MISSOURI.—Existing Roads.

(*Lines within limits of map only.*)

61. ***Chicago, St. Paul & Kansas City.***—Track laid in 1888, 3 miles south of Rea to St. Joseph, 19.1 miles.

Projects and Surveys.

64. ***Central Belt Line.***—Located, Macon to Bevier, 5.25 miles. President, J. A. Hudson; Chief Engineer C. J. DuBois; both of Macon.

65. ***Kingston & Polo Short Line.***—Projected, Kingston to Polo, 7 miles. President, C. W. Love; Chief Engineer, Johnson Boyde; both of Kingston.

66. ***St. Louis & Northwestern.***—Projected, Leon, Ia., to Monroe, Mo., 135 miles. President, S. M. Ricker; Chief Engineer, E. M. Collins; both of Kirksville.

The American Engineers in Germany.

(From our Special Correspondent.)

Mr. ARTHUR POU, C. E., one of the American engineers now abroad, sends us the following letter detailing some of the events of a reception by the engineers of Westphalia and the Rhine, July 2–5. The list of Americans who embraced the opportunity to visit the many German industries here thrown open to them is given as follows on the official programme:

James Archbald and ladies, N. M. Edwards, Theo. H. Robinson, Wm. H. Baldwin, Stanchiff B. Downes and lady, W. H. Brackenridge, F. E. Edwards, Prof. Wm. T. Magruder, C. Kirchoff, Jr. and ladies, F. H. Daniels and lady, Thomas G. Lovett, W. L. Sheafer, F. W. Sheafer, A. W. Sheafer, F. A. Hill, A. A. Stevenson, Walter Phillips, Walter Wood, G. Lavagnino, H. G. Reist, E. v. d'Invielliers, Oberlin Smith and lady, Mathias A. Beck, H. W. Wymann, James Christie, Ed. A. Uehling, Arthur Pou.

At the dinner of July 5, on top of the Drachenfels, the following was written for the occasion by Dr. BEUMER, of Dusseldorf, and a member of the Reception Committee. We leave the translation to our poetically-inclined readers:

Gruss und Handschlag Ihr Collegen
Von des Mississippi Strand,
Bringen jubelnd wir entgegen
Euch im deutschen Vaterland.
Auf des schönsten Stromes Wellen
Sehen wir wie voller Lust,
:,: Männer freudig sich gesellen
Arm in Arm und Brust an Brust. :,:

Und ich hör' die Wogen rauschen
Unsres alten Vaters Rhein:
„Solch ein Blick" und Redetauschen
Soll mir hochwilkommen sein.
Fahre zu du Dampfer mächtig,
Führ vorbei sie manchen Ort,
:,: Zeige meine Burgen prächtig
Allen, die bei dir an Bord." :,:

„Segnend dein Stromaufwärtsfahren
Leite dich der Götter Gunst,
Trägst ja Meister und Scholaren
Einer weitverzweigten Kunst.
Singt ihr Wellen sanft und leise
Manche süsse Melodei,
:,: Lehret sie die holde Weise
Von der blonden Loreley." :,:

Was der Rhein mit solchen Worten
Weit durch Berg und Thäler rief,
Oeffnet der Begeisterung Pforten,
Schaeund Euch ins Auge tief,
Reicht Ihr Euch im frohen Bunde
Bruderhand und Bruderkuss,
:,: Jeder deiser schönen Stunde
Freudig sich erinnern muss. :,:

Gruss und Handschlag reicht sie wieder
Brüder aus Amerika!
Deutscher Wein und deutsche Lieder
Sind in Ueberfülle da,
Auf dem Rhein beim Weinpokale
Ruft bei Rheinlands Rebensaft:
:,: *„Hoch die internationale*
Edle Kunst und Wissenschaft!" :,:

Mr. POU sketches this interesting trip of the American visitors as follows:

Having been taken to the top of the Eiffel tower and conducted through the Exposition, the original programme had been concluded, and the party disbanded, some to return home, some to see more of the Exposition, and some to visit other parts of Europe.

Among the last were those who visited Westphalia, at the invitation of the German engineers, and it is safe to say that from the 2d to the 5th of July, no happier party than they were gathered together in any part of the world.

The party had been through a continuous round of sight-seeing and feasting, from the 5th to the 30th of June, so that most of them preferred rest to any further excitement, and only about 40 went on the trip to Germany.

Those who were so unfortunate as not to be among this number may reproach themselves with having missed four as happy days as any that had passed since they left their homes, for the German reception was faultless, and their hearty welcome and genial manners made the visitors feel in a few moments as if they were among old friends instead of strangers.

It was not generally known, except to the members of the societies interested, that the American engineers proposed visiting Europe, and the German engineers had heard nothing of it till the party had left New York; but a meeting of the Verein Deutscher Eisenhuettenlete (German Iron & Steel Institute) and other organizations was held, a Reception Committee was appointed, and Mr. E. SCHRÖEDTER, the Hon. Secretary, instructed to meet the Americans in Liverpool, and extend to them a cordial invitation to visit Germany also.

The invitation was brought to the notice of the party by Mr. C. KIRCHOFF, at the general meetings in London and Paris, and a considerable number signified their acceptance of it.

It was at first proposed to leave Paris on the night of July 1, and take a sleeping car through to Aix-la-Chapelle, arriving there the next morning. A committee, having investigated the matter, reported that no regular sleepers were run, but that the railroad company would put on the necessary sleepers, provided all the party purchased first-class tickets and also sleeping-car tickets, and in addition paid the railroad company mileage for taking the cars back to Paris.

The party decided to take the day train, especially as they came to Europe to see the country, and did not care to pass over a large part of it during the night. Mr. CHAS. KIRCHOFF, editor of the *Iron Age*, was appointed to take charge of the party, and left Paris with some of them on the morning of July 1, the others following on the night train.

At the station before reaching Aix-la-Chapelle, the party was met by Mr. R. PARSONS, the American Consul, and at the depot in Aix-la Chapelle by Mr. SCHROEDTER and other members of the Reception Committee, who escorted them to the hotel and afterwards to points of interest in the city.

The next morning carriages were in waiting, and conveyed the party to the rolling mills and basic steel works at Roth-Erde. Here they were presented to the officers of the company, and after inspecting the works and partaking of an elegant lunch were driven to the lead and zinc smelting works at Stolberg. In the evening the party proceeded to Dusseldorf.

The next day was spent in visiting the Zollverein Collieries, the blast furnaces, and the coke ovens, and witnessing the preservation of the by-products at Gelsenkirchen, which were very interesting to those of the party who were interested in mining. Your correspondent not being familiar with the subject, can give no description of the process, but he noted down that from the coal used they obtain about 67 per cent. of coke, 2 per cent. of tar, and 1 per cent. of sulphate of ammonia.

The party were shown specimens of coke made from coal that had been brought from Pittsburg, which gave a considerably better percentage of coke.

In the evening all attended a conversazione in the Zoölogical Gardens, at Dusseldorf, given by the "Niederrheinischer Bezirksverein Deutscher Ingenieure," where feasting, conversation, and dancing were kept up till a late hour.

The glorious Fourth was spent in visiting various factories, mills, etc., of the Humboldt Co., at Kalk, and other works at other points, two lunches being disposed of as usual, with somewhat more than the regulation number of toasts and responses.

In the evening, the party attended the dinner given by the Dusseldorf Reception Committee. A large number of German engineers were present with their wives and daughters, and also a number of Americans residing in Dusseldorf, among them Mr. PARTELLO, the U. S. Consul, and family.

American flags were prominent among the decorations, the band played American airs, and the popping of champagne corks formed an agreeable substitute for fire crackers; so the party voted that the glorious Fourth was being celebrated very successfully. An address of welcome was made by the American Consul, and numerous toasts were proposed, and drunk with great enthusiasm, one of them, to "The Ladies," by Dr. BEUMER, of Dusseldorf, being without exception the neatest your corresp ndent has ever heard.

Coffee was served in the garden, and it was soon announced that the tables had been removed from the dining room, and that dancing was in order. The votaries of Terpsichore at once embraced the opportunity of doing her homage, and kept it up till the 4th of July, 1889, had become a thing of the past.

In deference to the motto of "Business before pleasure," all the days, so far, though passed pleasantly enough, had been devoted to the business part of the trip; but the Committee decided that the last day should be one of pleasure, unalloyed with any business or studies whatever, and at about the close of the dinner the following programme for the next day was circulated.

FRIDAY JULY 5.
Trip up the Rhine.

Leave Düsseldorf at 7.5 A. M. by Köln-Minden station. Arrival in Cologne at 7.45. Inspection of the cathedral (quite near the station) under the guidance of some architects of the town.

Leave Cologne at 9. Arrival in Coblentz at 10.47. (By rail.) Reception in the waiting room of the station by Mr. SPASTER, the President of the Coblentz Board of Trade. Go by carriage to the Imperial Palace. Reception of a deputation (Mr. OBERLIN SMITH, Mr. WOOD, Mr. KIRCHOFF) by Her Majesty the German Empress-Widow AUGUSTA.

Inspection of the palace and the public gardens on the border of the Rhine. Refreshments by order of Her Majesty. Go by carriage to the Champagne factories of Messrs. Deinhard & Co. Luncheon given by Messrs. Deinhard & Co.

Leave Coblentz at 2.30 by special steamer. Arrival in Königswinter at about 4.30 o'clock. Go by rack-wheeled railroad to the Drachenfels.

Dinner on the top of the Drachenfels.

7.30. Return by railroad to the steamer.

9 30 P. M. Arrival in Cologne.

Leave Cologne. To Düsseldorf by railroad at 10.30 or 11.40.

The programme was carried cut without a hitch, and in a more ample manner than was expressed. The trip down the Rhine was one which no member of the party can ever forget. There were about 40 American, and double that number of German ladies and gentlemen on board. The steamer was gaily decorated with German and American flags, and had a band of music and two cannons on board. Six cannon had been carried down to the wharf by the citizens of Coblentz, and as the steamer sailed down the Rhine, with the band playing and everyone cheering, they were fired as rapidly as they could be loaded. Salutes were also fired from numerous other points on the route.

From Königswinter the party were taken by the rack-wheeled railroad to the top of the Drachenfels, where a sumptuous dinner was partaken of. The usual toasts, cheers, and speeches were varied on this occasion by a new version of "Upidee," sung by Dr. BEUMER, the entire party joining in the chorus, and also by the singing by the party of a song written by Dr. BEUMER for the occasion.

The party were in the highest of spirits when they re embarked on the steamer and the journey down the Rhine was resumed.

In addition to the salutes fired from the shores, beautiful displays of fireworks appeared as soon as it was dark. Cologne was reached at 10 P. M., and the display of fireworks here was magnificent. An immense crowd, estimated at 6,000 to 8,000 people, had gathered on and near the wharf to see the engineers (and the fireworks), and cheered them as they landed with an imitation of the American "Hip, Hip, Hurrah!"

The streets were packed with people for four or five blocks, but the police had cleared a way, and the party proceeded to the railway station and thence by train to Dusseldorf, where, late at night, they parted from their hospitable hosts with a profound conviction of having done well in "taking in" the German trip.

Switzerland.

Switzerland, according to the catalogue of the Swiss section of the Paris Exposition, is composed of twenty-five cantons and demi-cantons, which have the power of government invested in them according to the articles of the constitution framed in 1874; they elect the members of the National Council in proportion to their population, that is to say, there is one deputy to each 20,000 persons, as well as two deputies to the States Council for each canton. These two authorities together form the Federal Assembly, which nominates the two supreme executive and judicial powers, the Federal Council which sits at Berne and the Federal tribunal at Lausanne. The Federal Council consists of seven members, and the Federal Assembly elects from their number annually the president of the confederation. Each canton has its own independent administration. The total population of Switzerland in 1888 was 2,934,057, the proportion of the sexes being almost equal; the most populous city in Switzerland is Zurich with 90,111 inhabitants, than follows Geneva with about 72,000; the number of foreigners in the whole of Switzerland was last year 238,313.

The language chiefly spoken is German, no less than 2,092,530 persons using that tongue; 637 972 people speak French; 156,606 speak Italian, and the remainder of the population make use of various languages. The Protestants and Catholics are not equally divided, there being about half a million more of the former than of the latter; there are some 8,000 Jews resident in the country, and 10,000 of the population profess other religions. Agriculture is the principal pursuit of the population, 41 per cent. being thus occupied; 37 per cent. pursue various industrial callings, 7 per cent. are commercial, and 4 per cent. follow administrative and scientific pursuits. Public instruction is carried to a high stage of development in Switzerland; the country contains about 3 800 scholastic communes in which are 544 infant schools 7,180 primary schools, and 452 secondary schools; these give employment to nearly 11,000 teachers, who are occupied nearly all the time with over half a million of pupils. The system of superior teaching includes normal schools, colleges, industrial and commercial schools, and agricultural and technical schools; the total number of pupils in these establishments is about 16,000.

There are several well-known polytechnics and universities, of which those of Zurich, Berne, Bâle, Geneva, Lausanne, Neûchatel, Lucerne, Fribourg, and Sion are the principal ones. In 1887 there were 2,300 students in these universities, besides 138 women; 753 of the total number were foreigners. The cost of conducting the primary schools is about $3,500,000 per annum. The total value of the exports from Switzerland is now about $134,000,000, of which the most important items are those of silk (385,000,000 francs), and watches and musical boxes (85,000,000 francs). Machinery is exported to the value of about $4,000,000, and cheese and preserved milk for $10,000,000; other important objects exported are cattle, skins, chemicals, and scientific apparatus. The export silk industry amounts to about $40,000 000; embroidery is exported to the annual value of nearly $20,000,000, and cotton goods for over $5,00,000. The value of goods imported into

Switzerland is $165,000,000. About 28.3 per cent. of the total area of the country is unproductive, and the total estimated value of real estate in the country is $680,000,000; the revenue obtained from agricultural operations is about $80,000,000; the cereals produced supply one-half of the requirements of the population; the value of the wine industry is nearly $10,000,000 per annum, and wine to about half that value is imported. The fruit crops produce a revenue of nearly $5,000,000 a year. The most important agricultural industry of Switzerland is that of dairy farming, the annual value of milk produced being at least $40 000,000; of this one-fourth is exported in the shape of cheese and compressed milk. The actual value of livestock in the country is estimated at nearly $40,000,000, cattle of course forming the larger part of this amount. The gross estimated value of the forests of Switzerland is $285,000,000, and the revenue annually produced is $8,000,000.

In 1887 there were 1,950 miles of railway in Switzerland, and in this length are included some of the most difficult examples of railway engineering that have ever been accomplished. In the year named, 25,762,822 persons were carried on the Swiss railways; and 8,096,858 tons of merchandise. The total receipts amounted to $15,800,000, and the expenses to $8,440,000; the capital expended in railroad construction was about $200,000,000, and the average interest paid on capital was 3.45 per cent. A total of 213 accidents of every kind is reported to have occurred on the system in 1887. Working to a large extent with the railways is the lake navigation, which in 1887 occupied sixty-eight large passenger steam vessels. The construction of tramways has made but little progress in Switzerland, there being less than 20 miles in work; these, however, carried in 1887 nearly 6,000,000 of passengers, with a profit of about 260,000 francs.

Last year there were 3,077 post offices in the confederation employing 6,639 assistants; the number of letters and postal cards delivered for the home service was over 71,000,000, the number of newspapers circulated being about the same: the money transmitted by postal orders was $58,800,000. The international transmission of mails was considerably less than half of the figures just given.

There are no less than 17,341 kilometres of telegraph lines connected with 1,325 offices, and employing 1,826 clerks; the total number of messages despatched last year was about 3,000,000, and the receipts of the administration showed an excess of about 500,000 francs over the expenditure. There are 11,812 kilometres of telephone lines in service, with 7,946 receiving and transmitting apparatus, and 6,881 subscribers. There is no Government bank in Switzerland, but by a federal law thirty-four different banks are authorized to issue their own notes; in 1888 the actual number of these notes in circulation was 183,000,000 francs, which represented almost the maximum authorized emission. The collective capital of the Swiss banks exceeds $110,000,000.

THE SHAH'S RAILWAY EXPERIENCE.—On the occasion of the last visit of the Shah, says the English *Railway Press*, he, on making his first railway journey in England, asked the use of the button which moved the connection with the engine-driver, and was told that it was for the purpose of stopping the train. Thereupon his Majesty rose and pulled it sharply, with the result which would have rendered any ordinary mortal subject to penalty or imprisonment. On being asked why he wished to stop the train, the Shah replied that he was tired and wished to go to sleep, and it was some little time before he could be made to understand that the traffic of the South-eastern railway must not be brought to a standstill for an hour even for the Shah-in-Shah.

A NEW TRANSATLANTIC CABLE is projected, and will be laid if the Canadian Government will guarantee the company's bonds to the amount of $500,000. The new line is to be owned by the Canadian Cable Company, and $250,000 of the capital required is already secured. The route will be from Greenly island, Straits of Belle Isle, to a point on the north of Ireland. It will therefore be the shortest of the Atlantic cables, and will be laid in much shallower water than the others, the depth being nowhere over 1,500 fathoms. A London company has offered to furnish, lay, and guarantee the cable for $1,500,000.

NATURAL GAS is to be furnished to Chicago by a syndicate headed by STEPHEN B. ELKINS and P. A. B. WIDENER, of Philadelphia, the street railway capitalists. Natural gas rights on over 60,000 acres of land in Indiana have been secured, and a pipe line 138 miles long is to be built. The Indiana law prohibiting the sending of gas out of the State stands in the way; but it is expected that this will be declared unconstitutional.

PERSONAL.

Mr. E. T. JEFFERY, General Manager of the Illinois Central, has resigned.

Mr. CHARLES H. HEATH, who was one of the promoters of the Montpelier & Wells River Ry., died at Barre, Vt., July 22.

Mr. A. CHANDON has been appointed Local Manager and General Auditor of the National Tube Works Co.'s business at McKeesport, Pa.

Capt. T. W. WHISTNANT, Roadmaster, has been appointed Superintendent of the Carolina Central Ry., vice Col. L. C. JONES, deceased.

Mrs. KATE C. VAN DEVANTER, wife of Mr. C. O. VAN DEVANTER, Civil Engineer on the Western Maryland Railroad, died suddenly at Hagerstown, Md., July 19.

Mr. GODFREY JACOBS, employed on the Philadelphia & Reading engineer corps, fell through a bridge at Schuylkill Haven recently, a distance of twenty-five feet, and received fatal injuries.

The Lehigh Valley Creosoting Co., of Perth Amboy, N. J., has removed its office to the foot of Washington St., south of the Gap, Jersey City, N. J., where communications should now be addressed.

Mr. F. S. BRITTON, Assistant Superintent of the western division of the Rome, Watertown & Ogdensburg, has resigned. His successor is Mr. W. S. JONES, Assistant Superintendent of the middle division.

Mr. L. M. SMITH, for some years Assistant Division Superintendent of the Wabash Railway, has severed his connection with that road, and accepted a similar place with the Eastern division of the Boston & Maine Railroad.

Mr. GEORGE S. LADD, of San Francisco, Cal., died in London on July 24. Mr. LADD organized the Pacific Bell Telephone Co. and became its president and was foremost in the utilization of electrical appliances of all kinds on the Pacific coast.

Mr. T. V. TROY has resigned the position of Superintendent of the Atlanta & Florida Railway. He goes to accept a position on the Georgia Midland. Mr. W. L. MCGILL has been appointed Acting Superintendent in place of Mr. TROY.

Mr. FRANCIS L. CAPEN, known as a weather expert, died in Boston on July 31, aged 72 years. Mr. CAPEN made many interesting astronomical discoveries and as he possessed a wonderful knowledge of atmospheric changes he made many remarkable weather predictions.

Mr. DANIEL BEEDY, referred to as a well-known bridge builder, died at Farmington, Me., on July 29, aged 78 years. He built a number of large mills for various purposes in Maine, Missouri, New Mexico and California, and also a large number of bridges.

Dr. W. B. ROBERTS, the originator of torpedoes for blasting oil wells, died in Titusville, Pa., on July 30, aged 51 years. In 1865 he, with his brother Mr. E. A. ROBERTS, organized the Roberts Torpedo Co., and the business paid so well that the deceased leaves an estate of $3,000,000.

Mr. HIRAM F. MILLS, of the Massachusetts State Board of Health and for many years engineer of the Essex Company's extensive water power properties at Lawrence, has been nominated by Gov. AMES as the third member on the Drainage Commission. Judge ASA FRENCH and Mr. HOSEA KINGMAN, the two lawyers, still remain, Mr. MILLS taking the place of Mr. J. Q. ADAMS, the third lawyer on the original commission.

J. G. HOLCOMBE and H. C. MILLER, Assistant Engineers on the Nicaragua Canal survey, who went out with the first expedition in 1887, returned by the steamer *Aguan* from Greytown, on July 25, after an absence of twenty months. Judging from the healthy appearance of the gentlemen after so long an experience with the climate of Nicaragua, we cannot but think that air of this tropical region is favorable to engineers at least. Both gentlemen report the climate as thoroughly satisfactory, and after a short season of rest they expect to return to their respective parties in the field. Mr. HOLCOMBE goes to Washington, D. C., and Mr. MILLER goes to Louisville, Ky.

Mr. CHARLEMAGNE TOWER, of Philadelphia, whose capital and enterprise have played a prominent part in the development of the Northwest, died on July 25, at the age of 81. Mr. TOWER practised law in this city in his early life and was prominent in the legal battles over the valuable coal properties in Pennsylvania now controlled by the Philadelphia & Reading Railroad Company. When the Northern Pacific enterprise was projected, he took a prominent part in it and was for several years a member of the Board of Directors. The greatest enterprise of Mr. TOWER's life was the development of the Vermillion iron district in Minnesota and the construction of the Duluth & Iron Range Railroad, to give it an outlet to market. As long ago as 1874 Mr. TOWER learned of the existence of iron ore deposits near Vermillion lake, 75 miles north of Duluth; but it was not till 1883 that work was actually begun on the construction of the railroad and the opening of the mines. The ore is of especial value for the production of Bessemer steel, and during 1887 over 400,000 tons were shipped from the mines. On June 5, 1887, Mr. TOWER sold the railroad and mines and about 20,000 acres of mineral lands to the syndicate which now controls it for over $6,000,000.

BOOK REVIEWS.

The Designing and Construction of Storage Reservoirs.—By ARTHUR JACOB, B. A., Late Executive Engineer for Irrigation, H. M. Bombay Service. Revised and extended by E. SHERMAN GOULD, M. Am. Soc. C. E., Consulting Engineer to the Scranton Gas & Water Co.

There is no occasion to tell our readers anything about Jacob's "Storage Reservoirs"; it is a small book, but so far about the only one on this subject that is of much importance. It is a good many years old now, but the recent revision, by Mr. GOULD, brings it up to date, and in accord with the best engineering practice of Europe and America. The footnotes are very valuable, but it is in the "Additional Remarks by the American Editor," comprising 31 pages, that we get the full measure of the value of Mr. GOULD'S revision. In connection with the "Specifications for Dams and Reservoirs," prepared by Mr. GOULD for the Scranton Water Works, and published by this journal, these "Additional Remarks" form the *very best* set of instructions for dam building that can be had in any language. At this time, when the disaster on the Conemaugh is not yet forgotten, but is stimulating an examination of similar structures throughout the world, and especially in this country, it is well for engineers, young and old, to be furnished in brief with the resumé of a successful practice, coupled with a critical examination of the best literature of the subject gathered from many sources. Hence the importance of having this little book and the specifications in the office of every engineer and contractor, so that they may be ready for any call for their services.

The little books of Van Nostrand's Science Series have not been indexed; hence we give an analysis of Mr. GOULD'S "Additional Remarks" for the benefit of whom it may concern, as follows:

The importance of storage reservoirs—In planning storage reservoirs there are two questions: How much stored water does our supply require? How much can our available resources be counted on to furnish? These questions are answered at length. Drainage area; available rainfall; daily supply; best location of reservoir; sort of dam to build; English and East Indian dams—earthen with puddle core—criticised; superior efficiency of masonry center wall; design, dimensions, and accessories of dam; spillway—its location and form; drawing off the water; center wall of masonry—its construction; materials; earthen embankments; pumping plants; management of the water; treatment of springs. Conclusion.

The building of dams and reservoirs belongs to one of the most important and responsible classes of work undertaken by the engineer, and no pains should be spared in their construction to insure satisfactory results.

SOCIETY PROCEEDINGS.

Montana Society of Civil Engineers.—The regular monthly meeting was held July 20, at the office of Mr. BECKLER, chief engineer of the Montana Central Railway, President B. H. GREENE in the chair; present, Messrs. SIZER, WHEELER, F. J. SMITH, FOSS, DANSE, DE LACY and KEERL.

Col. W. DE LACY, chairman of the Committee on Irrigation, submitted a progress report, which was made the basis of a general discussion upon the subject named.

A communication was received and read from Mr. A. B. KNIGHT, of Butte, relative to the irrigation question. He suggested that this "society anticipate the probable demand for legislative action and professional services in Montana by formulating legislation and by the consideration and discussion of the principles involved and the problems presented." Mr. KNIGHT expressed himself as being in favor of State control of all irrigation works. He also called attention to the necessity of providing through proper legislation for the inspection of highways and bridges. These features were discussed by the meeting at considerable length, and the opinion prevailed that the interests of the State demand that the best possible results should be secured in the public works, and that this could alone be secured through enactments which would place in the hands of a competent engineer the direction of all engineering works of a public character. The discussion resulted in the unanimous adoption of the following motion: "That Mr. KNIGHT'S letter be received and filed, and referred to a committe of five to be appointed to memorialize the constitutional convention, in the name of the society, on State control of irrigation, highways, and bridges, and that committee have full power to act." The chair appointed as such committee, Messrs. F. L. SIZER, A. B. KNIGHT, L. O. DANSE, W. W. DE LACY and GEO. O. FOSS.

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Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also,* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

Coming Technical Meetings.

National Electric Light Association.—A convention will be held at Niagara Falls, N. Y., Aug. 6, 7, 8. Secy., A. V. Garratt, 18 Cortlandt St., New York City.

New England Roadmasters' Association.—Annual meeting at Boston, Aug. 21. Secy., W. F. Ellis, Woonsocket, R. I.

Civil Engineers' Society of St. Paul, Minn.—Next meeting, Sept. 2. Secy., Geo. L. Wilson, City Hall.

Roadmasters' Association of America.—The annual convention will be held at Denver, Col., beginning Sept. 16. Secy., H. W. Reed, Waycross, Ga.

Boston Society of Civil Engineers.—Next meeting, Sept. 18. Secy., S. E. Tinkham, City Hall.

WE are pleased to see that Mayor GRANT is himself convinced that there is something in the vigorous manifestations of public disapproval of the location of the new municipal buildings on the City Hall Park. He has written to the commission having this matter in charge and suggests that before the final selection of a site, public opinion should be tested by permitting citizens to express their opinions at the Mayor's office, and Wednesday, Sept. 4, next, has been selected as the day for this hearing. Mayor GRANT, in his letter, evidently leans towards the park location; but he does so, he says, not from motives of economy, but because he believes that a building worthy of the city of New York should not be erected where its architectural beauty would be obscured by mean or inappropriate surroundings; and that it would be a difficult and embarrassing problem to secure this end outside of the park. To this we might answer that the location of this building on the corner of the park facing the Brooklyn bridge would scarcely result in the desired architectural success, as two of its sides would face on streets, just as would be the case were the building put on one of the built-up blocks suggested. There is not room enough in that part of the park to permit the open space to play any efficient part in setting off the buildings; but the park would be curtailed and in that much marred all the same.

As to mean surroundings, if another site were selected, we would remind the Mayor that the lower end of New York is rapidly undergoing a change in the character of its structures. Land is becoming too valuable to permit its occupation much longer by mean construction, and buildings deserving of this term are being rapidly replaced by others which in cost and architectural effect will probably rival the new public offices. They may be "inappropriate" as neighbors; but if economy is no object, the remedy for that is to keep these neighbors as far away as possible by appropriating more land. It will pay to do so, because, instead of cutting down the one spot of green we have now in this neighborhood, there is the chance to add to the city's adornment by wider streets surrounding a new public building. The additional expense of providing ample room, so that the structure may not be belittled by its surroundings, will be well met by its effect on these surroundings in increased taxable values, and the removal of any structure that is not adapted to the change in conditions will quickly follow. Lower New York is just now full of "inappropriate" buildings, where the towering structures that have cost millions to erect overshadow the type of building our fathers saw fit to occupy. But the latter are being crowded out month after month by the force of circumstances and increased values, and the demolition of a block of them for a new municipal building would only hasten the good work and quicken the change in its neighborhood.

THE long-discussed, troublesome, and still unsettled question of a better water supply for the city of Philadelphia has been taken up by the *Inquirer* of that city, and it has sent reporters to "thoroughly examine" the Schuylkill river from its upper sources to the intakes of the Philadelphia pumping stations. While reports on a technical question by the average representative of the daily press must be taken with many grains of allowance, and usually magnify conditions that are of least import to the expert and pass over others of vital importance, the statistics here gathered are not encouraging to the water consumers of the city in question. Says the *Inquirer*:—

> From Pottsville down to Reading, it is black and green and brown. From Reading down to Pottstown, it is brown and green and yellow. From Pottstown down to Perkiomen, it is every color that is dirty, and from Perkiomen down to Conshohocken, it looks not infrequently like a river of red mud. From Conshohocken down it changes from red to brown, and when it reaches the place from which it is pumped for the good people of Philadelphia to drink, it is a nasty, malodorous, coffee-colored mess, in which the fish cannot live, excepting a few dirty catfish, and which is unhealthy even to bathe in.

The Schuylkill river drains a region inhabited by over 250,000 people, and carries off the refuse of many manufacturing establishments. Despite the precautions of the authorities in cases under their control, the river is the easiest place of disposal for the general waste, and too much of it will get there by fair means or foul. Dirty and even bad-smelling water is not always necessarily dangerous to health; but the chances are always against the good condition of water flowing through a thickly settled district such as here described; and Philadelphia is rich enough, and owes it to her million of inhabitants, to earnestly push to completion some one of the several schemes fairly worked out for getting water from a better source of supply. Relief by filtration is practically impossible when it is a question of 80,000,000 galls. a day; and even if practicable, the cost of original construction and future maintenance had better be expended on a system of more perfect supply at the start. Neither filtration nor huge settling basins will remove all the impurities badly contaminated water may contain, and the clearest effluent from filter-beds or basins is always open to suspicion. Years ago, that veteran among American hydraulic engineers, Mr. JAMES P. KIRKWOOD, in discussing the Brooklyn water supply, said that the best treatment of water from an impure source was to *let it alone*, and go elsewhere for a better article that was above suspicion. This advice is as sound now as it was then. Philadelphia may have to go 90 miles, to the Delaware Water Gap, for a sufficiently abundant supply of pure water, and the estimated cost of so doing foots up into the round millions; but in a city of that size an epidemic which may very easily follow an unwise stretch of municipal economy may cause a much greater loss in life, general prosperity, and hard cash than is represented by the most magnificent aqueduct the conditions would require. The law limiting city debts and the city's general finances may seem to forbid the necessary expenditure; but means can be found for relief if the citizens and their representatives seriously go to work, and do less talking, discussing of analyses, and passing of prohibitory ordinances that do not prohibit because they cannot be enforced.

DR. CHARLES M. CRESSON, of Philadelphia, who has been for years keeping a sharp lookout upon the condition of the water furnished to the consumers of that city, writes to the Philadelphia *Press* that in 1866 there were 910 deaths from cholera in the city, of which 301 cases came from the three wards deriving their whole water supply from the notoriously foul intake of the Kensington water-works. The population of these wards was then one-seventh of the total city population. An attempt was made in 1862 to abolish this supply entirely, but the attempt failed. Had the measure been successful, the number of deaths from typhoid fever alone in these wards would have been reduced from 2,976 to 1,500, a saving of over 1,400 lives. And if at the same time such measures had been taken as would have reduced the death-rate from typhoid fever in the whole city to the present rate in London, a saving of 10,236 lives would have resulted. The number of deaths from typhoid fever and other diseases resulting from an impure water supply is given as follows:

	Typhoid fever	Inflammation of stomach and bowels.
1885	610	578
1886	618	631
1887	621	740
1888	785	754
Totals	2,634	2,703
1889 (to June 30)	354	310

According to this exhibit, the case is getting slowly but surely worse, and the jump in typhoid fever deaths from 1887 to 1888 is alarming. As every citizen is supposed to have a direct money value, his death must and does represent a loss in money to some one that might be prevented. But aside from the financial side of the question, there is a moral obligation resting upon municipal authorities to do all that can be done for the good health and prosperity of the city they represent. Death and disease from causes of this nature can be greatly reduced in number, as has been proven in the case of London and other cities; and when it is human life on the one hand and the expenditure of money and some considerable public enterprise on the other, the city rulers are false to their trust and the people themselves deserve little sympathy who allow mistaken economy to save dollars and squander life, and with life the good name and prosperity of the city.

THE Mayor of Philadelphia does credit neither to himself nor to the city he represents in a late interview in the Philadelphia *Press* on the water supply question. As reported he says that the city will soon have a storage capacity of 930,000,000 galls., or about a 10 days supply, and he believes this time will be

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SERIES OF MAPS: No. 17.

NORTH WESTERN STATES.

TRACK LAID DURING 1888,

TRACK LAID SINCE JAN. 1, 1889,

LINES UNDER CONTRACT OR CONSTRUCTION,

LINES SURVEYED OR UNDER SURVEY,

PROJECTS OF SOME PROMISE,

Figures refer to the accompanying list.
Lines having the same number are controlled in the same interest.

CONSTRUCTION IN COLORADO, WYOMING AND MONTANA WILL BE SHOWN ON ROCKY MOUNTAIN AND PACIFIC MAP.

MONT.
NO. DAK.
SO. DAK.
WYO.
NEB.
COL.
KAN.

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sufficient to allow "the germs that are in the water to settle and decay." He continues, "I am not a believer in analyses. Innoculation is the only way to determine these germs" whatever he may mean by the expression. He does not think the water would be benefited by coming from the upper Delaware, and still believes that, "when filtered," the Schuylkill water is as good as any. He asks the reporters why the city cannot manufacture water as he manufactures rope, and remarks, "That's my idea; I believe some time in the future this city will have to go way up in the mountains and build reservoirs holding two or three thousand millions of gallons and have it purified chemically. This is a big question and getting bigger every year." Mayor FITLER fails to mention how he proposes to get his water "away up in the mountains" and why he wants to get it there at all if he is going to purify it chemically. The Mayor further convicts himself and the city authorities by acknowledging that the city treasury gets a yearly profit of $1,200,000 from water rates collected from citizens who receive in return very bad water as a rule; his one regret is that if a syndicate undertakes to supply better water, this revenue will be cut off. Verily, the Mayor knows more about "making rope" than about managing the interests of a million people, and the sooner he returns to that congenial employment the better for the prosperity and good name of Philadelphia.

AMONG the appropriations made by Congress for the fiscal year ending June 30, 1890, is the sum of $15,000 for the use of a commission of three competent sanitary engineers, who "shall examine and report upon the system of sewerage existing in the District of Columbia, together with such suggestions and recommendations as may to them seem necessary or desirable for the modification and extension of the same." The District Commissioners last week transmitted a letter to the President asking him what is to be done in the matter, he being authorized to make the appointments. We have heard of this before, and also a vague but ugly rumor to the effect that the appropriation and act making it were engineered through Congress by parties who hoped to benefit by its provisions. If this be true, we can only most fervently hope that the promoters are to be disappointed; and we are encouraged in this hope by the good, hard sense which has usually controlled the appointments of President HARRISON. There are only a very few sanitary engineering experts in this country who could properly be called to a commission such as is here proposed; competent men, thoroughly familiar with sewerage practice and municipal engineering. We cannot mention names, nor is it necessary to do so, for their own reports on great public works of this nature sufficiently indicate who they are. If Washington is to be benefited by a report upon its present and future sewerage systems, it must secure the best talent this country can afford, and it is to the interest of Government officers to carefully sift the claims of all candidates for the office. The nature and amount of previous experience, and the quality of work actually performed should guide the selection, rather than any well-lobbied effort to push individuals who simply see "a place" that invites filling.

IN our article in last issue on "A Decade of Progress in Electricity," a provoking misprint occurs in the name of Prof. ELIHU THOMSON in connection with his invention of electric welding. Our only consolation is that Prof. THOMSON has so long been identified with electrical progress in this country that few readers would be deceived. But as a misspelled name is always annoying, and especially so when that name is connected with deeds that bring it prominently before the public, we hasten to make this correction.

COMMISSIONER GILROY in explaining that the salary for the newly created office of Consulting Engineer for Street Paving comes from the late office of Consulting Engineer to the Bureau of Sewers, and in further stating that this latter office was abolished because the services of the engineer holding it were "practically without value to the city," does a rank injustice to a civil engineer of wide reputation. Mr. GILROY is a politician, solely, and he should have added that the abolition of the last-named office was based upon a politician's estimate of the value of engineering service. His predecessor, Gen. NEWTON, was an engineer, and was therefore in a position to better appreciate the city's needs in the direction of a thorough overhauling of its antiquated down-town sewers, and he appointed an experienced and well-known engineer for this specific purpose. This engineer practically completed the preliminary work before Mr. GILROY came into office, and, as we understand it, tendered his resignation with his report, in case Mr. GILROY did not see fit to continue in the line laid down by his predecessor. It would have been much more graceful and just for the Commissioner to have stated these facts than to have cast an imputation upon an engineer whose reputation fortunately he cannot hurt.

ACTING as the agent of American engineers in recognizing the indebtedness of the profession of engineering to the late W. R. KUTTER, by a contribution of money to his widow, this journal had an agreeable task to perform. We have long ago conveyed to the generous contributors the heartfelt expressions of gratitude of the widow, and now have the further pleasure of sending out an official recognition of this act by Swiss engineers, expressing their appreciation of the goodness of heart of their American colleagues. The letter itself is addressed to Mr. RUDOLPH HERING, who, through his personal acquaintance with Mr. KUTTER, first recognized the great needs of his family, and led this journal to start the Kutter Fund. A translation of the letter is as follows:—

ZURICH, June 22, 1889.

DEAR SIR:—

At a recent meeting of members of the Swiss Society of Engineers and Architects, it was officially announced that a number of our professional colleagues from "the great country of progress" had generously contributed a fund for the family of our deceased member, Mr. KUTTER. The delegates to the convention express their deepest gratitude for this mark of esteem from beyond the ocean. They recognize therein a magnificent testimonial of the appreciation of meritorious achievement in the great field of science, and hereby express their sincerest thanks to their American brethren.

The convention has ordered us to communicate these resolutions to yourself and to your colleagues, together with an expression of the most esteemed friendship. In performing this duty we sign, with friendly greetings, in the name of the Central Committee of the Swiss Society of Engineers and Architects.

Dr. A. BURKLE-ZIEGLER,
Government Consulting Engineer.

Prof. E. GERLICH,
Actuary.

AN engineering correspondent of this journal has been for some time collecting data relating to the different types of trestles used on railways, with the purpose of final publication. While his efforts have been very successful, he still lacks detailed plans of trestles constructed of *round* timber, though such trestles are built in some parts of the country. He would be, therefore, much indebted for drawings or blue-prints of construction of this special type to complete his series. Address Mr. WOLCOTT C. FOSTER, 377 Quincy St., Brooklyn, N. Y.

Railway Construction in the Northwest.

To anyone familiar with the status of existing Northwestern railways, as outlined in the opinions of well informed railway managers, published in the daily papers recently, it may seem strange that anyone at the present time is rash enough to invest his money in building new railway lines in the Northwest. It is in this section that the building of competing lines has already been overdone, as everyone confesses, and the hostile railway legislation, which is generally considered to be the worst evil railway investors have to fear, has been carried on chiefly in Illinois, Wisconsin, Minnesota, Iowa, and Nebraska, all of which States are included upon our map.

It is true, indeed, that railway construction in this section has greatly fallen off; but the common impression that it has entirely stopped, our map and the following table shows to be wide of the mark.

States.	Track laid.		In process of constr'c tion.	Located & under survey.	Projects of some promise.
	1888	1889			
Ill.....	273	14	169	387	874
Wis.....	163	5	79	573	687
Man.....	92	52	425	436	1280
Minn....	284	16	55	169	984
Dak.....	118	..	382	45	565
Neb.....	193	35	215	324	347
Ia.....	37	..	113	8	222
Total..	1159	122	1258	1933	4959

To compare the above with the status of work at the date of publication of our last map of Northwestern construction (Jan. 28, 1888) we will leave out the mileage of Manitoba, as that was not included there. We have then the following comparative figures:

	Under Construction.	*Under Survey.*	*Projected.*
Jan. 28, 1888....	1857	5050	4254
Aug. 3, 1889....	833	1497	3479

In comparing these two sets of figures, it should be remembered that the mileage "under construction" includes lines for which contracts have been let, and graded lines on which work is now at a standstill but is expected to be resumed at an early date, as well as the lines on which actual construction is going on at the present time. Of the 833 miles in the above total, not more than 600 miles are being actively pushed to completion at the present time. The mileage classed as "under survey" includes a large number of lines which have been more or less definitely located, and are likely to go on, but on which engineers are not now at work; while many surveyed lines on which the prospect for future work is more indefinite, are classed under "projected."

A comparison of the two maps is of great interest. Many of the proposed roads which were then under survey, and were being actively pushed by their promoters, have been put back into the class of "projects;" while others have been left off this map entirely, there being not life enough in the enterprise at present to justify its inclusion in our list.

Last year's tracklaying forms a prominent feature on the map. The work is massed in three groups, one lying adjacent to Chicago, another located in the region tributary to Duluth, and a third in the district southeast of Lincoln, Neb. Besides the lines included in these groups, there were the Sioux Falls extension of the St. Paul, Minneapolis and Manitoba system, the longest line built in the

Northwest last year, and a half dozen short lines in various localities.

A noticeable feature of the work in the Northwest is that the great systems are doing practically nothing in the way of extensions. The only important exceptions to this are the 160-mile line which the Chicago, Burlington & Quincy managers are pushing into the Wyoming coal fields, and the two short lines which the Northern Pacific has under way in Minnesota and Dakota. The line shown on the map as under construction to Bismarck belongs to the Sault system, but no work is being done on it at present.

Taking up briefly the work under way in each State: The li es under way and projected in Illinois are principally south of the limits of our map, but will be shown on our map of Southwestern construction. The largest and most important line now under construction in the State is the extension of the Louisville, Evansville & St. Louis, from Belleville, near St. Louis, east to Mt. Vernon, nearly 70 miles. This line will give the system controlled by D. J. MACKEY, which, with the extensions now under construction, will soon have an extent of over 1,000 miles, a direct outlet to St. Louis. Other lines under construction in southern Illinois are the Centralia & Chester, an independent local line whose proposed length is about 100 miles, and the Grand Tower & East Cape Girardeau, which is to run for 30 miles along the east bank of the Mississippi river.

The most important line under survey in Illinois is the extension of the Indianapolis, Decatur & Western (the old Indiana, Bloomington & Western) from Decatur west to Beardstown, 80 miles. It is probable that this work will be put under contract before many months. It will eventually be continued west to Quincy, where it will strike one of the most important junctions of the Burlington system. A scheme in connection with this, which is shown on our map although still in embryo, is for a line from Beardstown west to Quincy, thence over the Quincy, Missouri & Pacific to Trenton, Mo., and thence by the proposed St. Louis, Quincy Omaha & Sioux City to Omaha, Neb. The other proposed lines in central and eastern Illinois may be noted by reference to our map and list.

In Wisconsin very little construction is now under way, and that little is principally short lines in the timber regions. The longest and most important extension now under way is the new line of the Milwaukee, Lake Shore & Western system through the Tomahawk lake district, which will, when completed, greatly shorten the company's line from Milwaukee to Ashland. Tracklayers will soon begin work and trains are to be running before the end of the year. The company will probably continue its policy of building branches as fast as needed to develop the timber districts adjacent to the main line. Of the many projected and surveyed lines in the State, those on which most work has been done and which seem to have on the whole the most of a chance for success, are shown upon the map. The most important are the Wisconsin Midland, running north and south in the eastern part of the State, the Escanaba, Twin City & Western, projected to run parallel to the Minneapolis, St. Paul & Sault Ste. Marie road at a distance of about 30 miles south, the Eau Claire, Mississippi & Lake Superior, proposed to run from a point opposite Winona, Minn., to Ashland, Wis., and the Kickapoo Valley & Northern, penetrating a tract of country southeast from La Crosse.

In the north Michigan peninsula the Milwaukee & Northern is extending the old Ontonagon & Brule River road south to a connection with the Duluth, South Shore & Atlantic; and there is an independent enterprise which has for its object the connection of the Milwaukee, Lake Shore & Western system with the copper-mining district.

Manitoba and the Canadian Northwestern provinces are north of the limits of our map, but the work is included in our list. The work of the two rival lines—the Canadian Pacific and the Northern Pacific & Manitoba—with one or two independent enterprises, promises to make that district unusually active in railway construction for at least two years to come.

In Minnesota the Northern Pacific is building a cut-off about 30 miles long from Little Falls northwest; and the Sioux City & Northern, which crosses the southwestern corner of the State, is reported under contract. Surveyors are reported at work on the old scheme for a direct line from Duluth to Winnipeg, and the Winona & Southwestern has been located from the end of last year's track to Mason City, Ia. This is all the active work there is in the State. Of the various companies which two years ago proposed to duplicate the network of lines which already covers the southern half of the State, a few are keeping up their organization and hoping for a better outlook for their schemes at some time in the future. The majority, however, have quietly succumbed to the inevitable. Of the enterprises shown upon our map, those in the northern portion of the State seem to have the best prospects. With the gradual exhaustion of the Wisconsin and Michigan timber lands, the forests lying in the great untouched tracts in northern Minnesota will be penetrated in every direction by railways. Probably the St. Paul, Minneapolis & Manitoba, which has already made extensive surveys for lines through this region, will be among the first to occupy it; but other independent companies are likely to contest the field. The promoters of the Duluth & Winnipeg, about which so much was heard a few months ago, seem to have been disgusted at their failure to secure the expected swamp land grant from the State, and they will probably do nothing more than build a road for lumber traffic along the St. Louis river.

The Winona & Southwestern has better backing than any other enterprise in the State. But the gentlemen who are interested in it and are amply able to secure the funds to build it, evidently do not propose to go ahead any farther until there are better prospects that the legislatures of Minnesota and Iowa will permit the road to earn a fair return for its owners. The Duluth, Red Wing & Southern Railroad is one of the few companies flourishing two years ago which has been able to complete and operate a small portion of its line. It is doubtful whether it will ever be able to carry the work any farther.

In Dakota the railway companies show no disposition to open up the Missouri river valley ahead of settlement; and the independent projects, of which but few have enough stability to justify their inclusion on our map, are located in the eastern portion of the State, already well covered with railways. The graded extension of the Minneapolis, St. Paul & Sault Ste. Marie will probably be laid with rails before many months. The line surveyed many years ago across the Cheyenne Indian reservation by the Chicago & Northwestern will perhaps be built upon if the opening of that tract to settlement is followed by an influx of immigration. There are several projects for lines in the Black Hills region, but it is doubtful if capital can be secured at the present time to carry them through.

Nebraska shows more work actually under way than any other State of the Northwest. The most important enterprise in the State, and about the most important independent enterprise now under way in the United States, is the Pacific Short Line Railway, to run from Sioux City Ia., to Salt Lake City, Utah. The reconnoissance and preliminary surveys for the line and the legal work in securing charters, etc., were begun over two years ago, and the line has now been surveyed and pretty definitely located for the whole distance of about 900 miles. About 100 miles from Sioux City west are now being graded, and additional contracts are to be let, according to report, as fast as possible. Who the parties are back of this extension, and where they expect profits from their enterprise, are standing queries. That they do expect profits, however, is proved by the fact that they are investing their money in the work after an examination of the country through which the line is to run. It seems probable that their main reliance is on the mineral resources of central Wyoming, which their proposed road would effectively develop. It is to be noted, also, that their line in Nebraska for the most part does not closely parallel the existing lines, and it will in time secure a good traffic. We discussed some time ago the reports that the Illinois Central was the power behind this enterprise, and it seems still pretty certain that the line when completed will form part of the Illinois Central system. In saying this, however, we do not express any opinion that the managers of the Illinois Central system are directly or indirectly interested in it. At the present time the corporation building the Pacific Short Line has doubtless no relations whatever with the Illinois Central Co. But if large stockholders of the Illinois Central or any other company choose to combine and build a railway as an independent enterprise, they have as much right to do so as any other body of citizens, and the road may gravitate into the hands of the Illinois Central in the end just the same. The logic of events seems to prove that the only power that can regulate railway building is the Government.

The extension of the Chicago, Burlington & Quincy system to the Wyoming coal fields west of the Black Hills has been already noticed. Tracklaying is now in progress upon it at the rate of a mile and a half a day. It is probable that, with the development of the mines, this extension will furnish a good traffic to the Grand Island extension, whose returns thus far, if we are rightly informed, have been pretty meagre. Certainly there must be a very sure prospect of the extension proving a profitable enterprise, or the company would not have pushed it through this year. One other line now under construction in Nebraska is seen in the northeastern part of the State running from Norfolk north to Yankton, Dak.

Iowa shows only two lines of any importance. The Sioux City & Northern has just been placed under contract and is to run from Sioux City to Flandreau, Dak., 120 miles. It is somewhat difficult to see where the promoters of the enterprise expect to reap profits by its operation, since it closely parallels established roads not at present overburdened with traffic. The Davenport, Iowa & Dakota has done nothing whatever on its road since the end of last year, so far as we can learn, and it seems unlikely that the enterprise will be carried any further. There will have to be a radical change in public sentiment in Iowa before investors will be inclined to advance funds to build new roads in that State. It is true, doubtless, that the extent of the injury done the roads of that State by legislation

has been much exaggerated, but the reports have gone out, and have been accepted as truth by the investing public, which is about as ignorant and credulous in matters of finance as the rural legislators themselves.

While the dearth of new railway enterprises in Iowa is noticeable, it seems unwise to base the claims of the railways to their right to earn fair returns for their owners on any other ground than that of simple justice. To tell the truth Iowa, is pretty well supplied with railways already. What the State needs is the improvement of existing lines and systems and the construction of short feeders, to correspond with the growth of the State, and not the building of new competing trunk lines across her territory. So far as the restrictive legislation put a veto on these enterprises, it was a good thing for all parties concerned.

It should not be misunderstood from the above that we consider the work of railway construction in these States, or in any others for that matter, as anywhere near complete. The cost of railway construction equipment, and operation, and the rate of interest on capital are decreasing continually and rapidly; and as this goes on, enterprises continually become feasible which were not so before, from a financial standpoint. The Northwestern States are the granary of the country, and the heavy products of the prairies will furnish profitable traffic some day to many thousands of miles of railway to be built where now only common roads exist. But before this is done certain vexed questions concerning the right of the railway to earn its living without State interference will have to be settled, and settled permanently.

Standard Rail Sections.

THERE was never so fair a prospect of attaining that long-desired but heretofore almost hopeless desideratum, a set of generally accepted standard rail sections, as since the appearance of the report of the American Society of Civil Engineers, on the "Proper Relation to Each Other of the Sections of Railway Wheels and Rails," which we have recently published, and the resulting resolution, which was in effect recommended in the report, to appoint a committee for the specific purpose of recommending standard forms of rail sections for weights varying by 5 lbs. per yd. from 40 to 100 lbs. per yd. This resolution has still to be submitted to letter ballot, but there can hardly be a doubt that it will be adopted almost unanimously in view of the very satisfactory results which the late Committee on the Form of the Head of Rails (as it was in substance) were able to obtain.

The greatest difficulty of all would naturally arise in respect to the form of the head, that being the wearing part. Yet the committee, by circulars of inquiry, after the publication of their first preliminary report, in which all the arguments, *pro* and *con*, were gone into, developed practical unanimity of opinion in regard to the following details: a 12-in. top radius; a broad and relatively shallow head; a ½-in. corner radius; a 1 16-in. lower corner radius; and a vertical side. The vote on these questions—abstracting from the report the substance of the response—showed the following very remarkable degree of agreement:

Favoring	12-in. top radius	44;	against it,	8
"	broad shallow head	43;	" "	2
"	½-in. corner radius	46;	" "	4
"	1-16-in. lower "	35;	" "	6
"	vertical sides	43;	" "	3

The mere numbers alone, we may add, strongly as they tend in one direction, do not represent the full extent of the approach to unanimity. In the first place, the seven members of the committee should be added to the majority; in the second place, with notable individual exceptions, the majority seems to be those who have given the question a most steady attention. This will appear more clearly when all the responses are published in full, as they shortly will be. Nearly all those who have sent in careful and full responses are with the majority; but the bare "face of the returns" shows quite sufficient unanimity to make it incumbent on every reasonable man to accept and act upon the conclusions of the majority, first because so many men in agreement are much more likely to be right than any individual, and second, because, even if wrong, they can hardly be far wrong, and unanimity of practice is highly desirable.

There remain unsolved, however, some very knotty questions in regard to other details of sections before final agreement on an entire series of standard sections can be reached. There is, in the first place, the slope of the under side of the head: shall it be little or much? Secondly, there is the question of fillet radii for the web: shall they be long or short? There are strong arguments in favor of each conclusion, and considerable difference of opinion is likely to develop. Thirdly, shall the sides of the web be concave or straight? Present practice favors concave sides, but there is not likely to be much dispute over this point. The concave sides are an absurdity, thinning the metal at a point where it is most injurious for rolling, and a point furthest removed from head and base, so that a considerably higher temperature is required to make the web sufficiently hot for the final passes. Fourthly, there is the question of the thickness and the form of the ends of the base, as to which there is now great diversity of practice, but which is not likely to cause great controversy. And, finally, there is the very important question of total width of base compared with height, as to which there may be considerable controversy and difference of opinion. Present practice tends to crystallize on the very convenient proportion of base = height. If the base be 4½, 4¾, or 5 ins., the total height is made the same; and this is not only a convenient and simple rule, but it has in its favor the strong argument that it affords a very ample bearing on the tie.

It is not to be forgotten, however, that European practice is almost a unit against this proportion in favor of a narrower base. Moreover, a wide and thin base is one of the most potent causes for enforcing a high temperature in rolling, thus decreasing the amount of effective compressive work done on the comparatively thick and narrow head. The spirit of the report of the late committee, which emphasizes the importance of reducing the differences of mass and form as much as possible, seems to imply that an effort will be made to secure agreement on a somewhat narrower and thicker base, as well as on the somewhat wider and shallower head which has been already recommended and practically agreed on, with a view to bringing the section as a whole to a closer approach to symmetrical form about the horizontal axis.

On this, as stated, there will be likely to arise considerable difference of opinion. There will be a natural and proper reluctance to give up any part of the bearing surface on the ties, and it is possible that the investigations which the committee will undoubtedly make will show that such surrender is unnecessary. However, it can hardly be made without an accompanying recommendation for the use of tie-plates under all the heavier sections, especially on curves and on ties of the softer woods.

But has not the time come when, in any case, such use of tie plates is expedient? It appears to us that it clearly has come. Precisely what the form and thickness of the tie-plate should be, we cannot undertake to say; but inasmuch as only one-third of the rail at most bears on the ties, it is evident that it is cheaper to put the necessary metal bearing surface on the ties only, rather than on the whole length of the rail; while the tie plate enables the bearing to be made as large and complete as desired, and in all cases better than a bare rail can possibly afford. Is it, therefore, worth while to even run a chance of injuring the quality of the rail for the sake of preserving a width of bearing which at best is far inferior to what is otherwise obtainable at moderate cost?

Clearly not, it seems to us. We are already behind the necessities of the case in respect to bearing surface. Heavier engines and cars and higher speeds have not been met by a corresponding increase of tie bearing, or even of weight of rail. As a consequence, the ties begin to cut early in their lives and the rails to tip over and gradually to draw the inside spikes. It is impossible to widen the base further: the very suggestion of making the base wider than the height would be received with universal ridicule. It is comparatively easy to provide sufficient stiffness in the rail itself by using heavier rails, because the stiffness of a rail is as the cube of the depth; but the base only increases as the depth, and, what is still more important, when base and depth increase together, the tendency to cut and overturn is *not decreased at all by increase of section*, since the leverage remains the same, while it is increased by the greater loads and speeds passing over the rails. Therefore, the need for some form of tie plate is constantly increased, and can be met in no other known way than by a tie-plate. But if we may assume a tie-plate to be used as a matter of course with the heavier sections, all serious objection to a slight narrowing of the base disappears, if there is any contravening good to be gained thereby.

Our own conviction, which we have many times before expressed, is that we are rapidly coming to the general use of very much heavier sections, and that 90 or 100 lb. rails, rather than 60 and 66 lbs., will soon be those most commonly laid down. We believe that one of the editors of this journal, almost four years ago, made the first suggestion that the time for 100-lb. rail was already at hand. It then seemed a rather remote possibility, perhaps, and not an immediate issue; but the idea was at once taken up in England by Mr. SANDBERG and developed in his "Goliath rail" of 100-lb. section, which has since been increased to 106 and 108 lbs. and is rapidly coming into wide use abroad. The Chignecto ship railway in Nova Scotia, as to which we shall have some interesting details to give shortly, is to have a double track of 110-lb. rails, which are already rolled. Such lines as the Manhattan Elevated, which began with 50 and 56 lb. rails, are now using 90-lb. while the laying of 90-lb. rails on any of the trunk lines no longer attracts particular attention.

There is an evident reason for this, apart from the increase in weight and speed of rolling stock. When iron rails which only lasted a few months cost $60 or $70 a ton, and steel rails cost $150 to $200, it was plainly impolitic, and impossible even, to consider the use of very heavy sections, especially as the rate of interest on capital was in those days nearly twice what it is now. But with steel rails down to $30 or less per ton, and quite sure to

tend to a lower rather than a higher price; with the cost of capital low, and tending lower; and with traffic multiplying in an incredibly rapid ratio, even in Europe, so that the yearly interest cost of rails per train mile is in any case falling fast,—the use of very heavy sections becomes a quite different matter, and as clearly economical as it formerly was extravagant, always provided quality is secured and maintained.

Our opinion is, therefore, that, instead of recommending sections between 40 lbs. and 100 lbs. only, the committee should extend their inquiries to a 110-lb. and a 120-lb. section, in order to cover what is extremely likely to be a demand of the near future, if not a present requirement. The suggestion, and it seems an eminently wise one, has been made, that there should be no attempt, in the first instance, to elaborate acceptable sections varying by 5 lbs., but that all efforts should be expended first on securing agreement on sections varying say, by 20 lbs., namely, 40-lb., 60-lb., 80-lb., 100-lb., and 120-lb. sections. These once determined and accepted, the task of filling in intermediates for each 5 lbs. per yard of section would be a comparatively light one.

In order to secure the important element of quality, however, there is room for question if it be not as important to standardize the form of rolls and number of passes, and the temperature at which the rails leave the rolls, as to standardize sections. The temperature can be fixed by specifying a maximum distance apart of the saws, which cut off the rails hot, so that they will contract to 30-ft. lengths. This is done in Mr. DELANO'S proposed specifications, which we lately published, and it seems a most desirable and important provision. The maximum should be small enough to have the rails rolled as cold as possible, and there might prove to be considerable difference of opinion as to what this maximum should be.

Another like detail, intimately connected with the first, which it would be important to standardize if possible, is the maximum circumferential speed of the rolls. The colder the rail, the slower this would have to be; and in all cases, in our judgment, the slower it is, the better the resulting quality of the rail.

The form of the rolls for the successive passes evidently has a very important bearing on quality. Speed, temperature, and number of passes being constant, it is evident that if one set of rolls did most of its work on the rough bloom in a hot state, and another on the nearly finished rail in the cold state, the result would be likely to be a very different quality of rail. In these details, we are confident, lies a good deal of the trouble in regard to quality of rails, and it is probable that inquiry will show very great differences of practice between the different rolling mills, which, if they have regard to their own interests, will welcome such inquiry.

There is still another question intimately connected with that of rail sections, and which it will probably be impossible wholly to separate from it, that of rail joint sections. The work of the committee would be not half completed if they should fail to secure agreement, before abandoning their work, on a set of standard joint sections; for unless joints, as well as rails, can be rolled for stock, so as to fill orders on demand, much of the advantage of standards will be lost. Every one who is buying new rails wants to buy new joints also at the same time, and if he cannot get both, neither one is of much advantage to him; and the great practical desideratum which is sought in establishing standard sections, apart from that of determining what is scientifically the best form, is to make it possible for mills to roll for stock, when they have no specific orders on hand, thus enabling them to eliminate the evil effects of irregular demand. The economy is strictly analogous to that which obtains in the manufacture of ready-made, as compared with custom-made, clothes, although, to make the comparison a perfect one, we should also have to assume that all buyers of clothing, ready-made and custom-made, wanted but one quality and that the best. It is easy to see how immensely such conditions would increase the already great economy of making clothes by wholesale instead of to individual order; and so it is with rails. The good wishes of the whole profession, and of railroad men throughout the continent, will go with the committee in their effort to bring about such a condition, which, we may be sure, will require some work and will not be done in a moment.

CORRESPONDENCE.

Carbonized Cement Pipe.

376 WHITING AVE., NEW HAVEN, Conn., July 10, 1889.
TO THE EDITOR OF ENGINEERING NEWS:—

In your issue of June 29, p. 596, you publish a letter signed "Municipal," under the heading of "Carbonized Cement Pipe." The question raised by this correspondent is one that has given rise to a great deal of discussion and argument in the past, and it is still a mooted question.

The manufacturer of cement pipe finds that by the use of the so-called "carbonizing" process, he can master the induration of his wares, thereby enabling him to place them upon the market earlier than when hardened in the natural way; besides, he can handle and stack up his pipe quicker after leaving the molds. This is why he uses the process.

As to the question whether "the pipe would not be more durable if it were not carbonized," much depends on the nature of the cement used. Slow setting cements will bear the treatment better than the quick setting brands. The process is simply a forcing of the set. The induration of a cement pipe, after it has left the molds, is due to the crystallization of the silicates through moisture. If the process is slow, the particles assume a regular arrangement, the substance fastening itself to the sand and gravel, in a regular form, in accordance with its natural laws; but if the process is hurried too rapidly, irregular and imperfect crystallization is sure to follow; and as this process is due to refrigeration or evaporation, it follows that if the moisture is expelled by heat or force before the silicates can have fairly combined with the water of crystallization, the effect cannot but be detrimental, for it is extremely doubtful if the crystallizing process can again be taken up after the pipe has been buried in the earth.

This idea is fairly well demonstrated by taking several briquettes of neat cement, made from one sample, and placing a portion of them, say on the roof of a building, and another portion on the ground; then, at the expiration of a month, take those on the roof and place them on the ground with the others, and after they are 90 days old a tensile strain test will show a vast difference in the quality of the briquettes. Those that remained on the ground will be tough as well as hard, while those exposed on the roof will be brittle, and show signs of disintegration, and if a portion appear hard and perfect they will not sustain a tensile strain equal to those placed on the ground throughout the 90 days. The reason for this is found in the fact that those on the roof were deprived of moisture too suddenly, and a subsequent contact with moist earth cannot restore the loss.

The process called "carbonizing" cannot, in our opinion, have any other effect than a rapid drying out of the pipe. We cannot conceive any benefit from the gases of carbon. The idea of the originator of the process was that, through the burning of charcoal, carbonic acid would be produced which would combine with the lime in the cement, thus forming carbonate of lime, which was supposed to aid induration. Now, the facts are that little, if any, carbonic acid is given off during the burning of the charcoal. Probably 97 per cent. of the gases is carbonic oxide, which could not combine with lime if there were any lime there to combine with, and even if the gases were carbonic acid, it could only combine with free or caustic lime; and the latter is found only to an extremely limited extent in the cements used for pipe making. The lime, having already combined with the silicic acid, is entirely out of the reach of any volatile acid. With this view of the case, we can see no benefit to be derived from the gases, and it is more than probable that the hastening of induration is due solely to the high temperature and dryness in the carbonizing kiln, which, as we have attempted to show, is attended with danger through interruption of the process of crystallization.

Unlike a clay sewer pipe, which is at its best when new, and if soft burnt is sure to go to decay, however skillfully a salt glaze may have been applied, the cement pipe is at its poorest when new, and if properly made from good materials should improve in quality with time, and finally reach a stone-like condition, a result unavoidable if natural crystallization is undisturbed; and any result contrary to this—if the pipe was hard before placing in the trench—can be traced directly to disturbed or arrested crystallization in the carbonizing kiln.

The efflorescence noticed by "Municipal" on "all good concrete and masonry," can hardly be considered as a sign of good quality, although we have oftentimes noticed it on good cement sewer pipe.

It is the result of the presence of soluble silicates in the cement, such as those of soda or potash, and the less of these in a cement the better for it. The amount of efflorescence is a fair measure of the work of disintegration going on in the cement, although it is but slight, as the percentage of these salts is comparatively small.

Yours truly, URIAH CUMMINGS,
General Manager Standard Cement Co.

The Degree of C. E. at the University of Alabama.

P. O. UNIVERSITY OF ALABAMA, July 24, 1889.
TO THE EDITOR OF ENGINEERING NEWS:—

The issue of the NEWS published on July 3, 1889, refers to an article of the *Evening Post* which gives, among other colleges, the University of Alabama as conferring the degree of C. E. upon the completion of the undergraduate course in engineering.

This statement is erroneous. A catalogue of 1888-89, just published, will show the names of thirteen Bachelors of Engineering in course, and of three C. E.'s who received the honorary degree. The degree of C. E. is conferred upon engineers for professional work.

You cannot correct errors made by others which you copy, of course, without responsibility.

But I agree so fully with the views you express "that the preliminary degree should be B. E., and the degree of C. E. should be conferred only after a certain number of years of successful practice of engineering," that I make this statement to show what is the practice in the University of Alabama. R. A. HARDAWAY,
Professor of Civil Engineering.

[We are glad to make the correction indicated by Prof. HARDAWAY'S letter and to add one more to our list of colleges adopting the more sensible course referred to in our note of July 13. We are also notified that at Rutger's College the degree of C. E. is only conferred after a four years course in the Scientific School and not less than three years actual practice in the field and satisfactory evidence of this presented to the faculty.—ED. ENG. NEWS.]

Notes and Queries.

J. R. E.—Australia, Miss. Which book would you recommend, Johnson's or Gillespie's Complete Surveying? Also, what is the best book on lettering and topography?

Johnson's "Surveying" is now the standard: in five years we have not sold over two copies of Gillespie, while it is a poor week when we do not sell one or more of Johnson's. "Topographical Drawing and Sketching" is an excellent quarto, price $3.50, and it can be accepted as having no superior; the same book, including "Photography Applied to Surveying," is $5; it is written by Lieut. HENRY A. REID, Assistant Professor of Drawing, U. S. Military Academy, West Point. The "Manual of Topographical Drawing," price $2.50, by Lieut. R. S. SMITH, a predecessor of Lieut. REID at West Point, revised and enlarged by CHAS. MCMILLAN, C. E., Professor Civil Engineering, College of New Jersey, is octavo, and has long been looked upon as a standard work. We really do not know the best book on lettering: they are all poor enough. Get a sample book from a type foundry.

J. S. D., Aurora, Ills. Cross' Field Book received. I notice it is No. 2, of ENGINEERING NEWS Popular Library. What is No. 1, and are there any others in print? They are as follows:

No. 1. "A Business Man," by ARTHUR HELPS, 10 cents.

No. 2. "Engineers' Field Book," by C. S. CROSS, C. E. 25 cents.

No. 3. "Accidents in Mines." 50 cents.

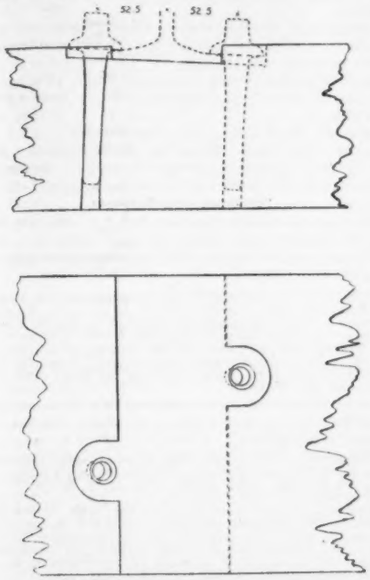
No. 4 "Engineers' Surveying Instruments; Their Construction and Use," by I. O. BAKER, C. E., 50 cents.

No. 5. "Drainage Tables," by GEORGE H. JOHNSON, C. E., S. D. 25 cents.

No. 6. "Explosives and their Composition," by WOLCOTT C. FOSTER. 30 cen

Standard System of Tracklaying, French Company of Venezuelan Railways.

The accompanying cut shows without further description the system of tracklaying adopted by this company, which is practically the ordinary French system of tracklaying. In accordance with European practice, the rails are given an inward inclination, and in order to do this an inclined seat is



Rail Fastening: Venzuelan Railways.

cut in the tie, and recesses are also cut for the heads of the spikes. The spikes are of a peculiar pattern: the heads are similar to those used in France for screw spikes, but no thread is shown on the drawing from which our illustration is made. "Cutting" of the ties is anticipated by boxing it out in the first place, the base of the tie being given a cant by cutting down to an unequal depth on the sides The ties are of lignum vitæ or other similar harp wood, and have to be bored for the spike; probably a form of spike differing from the ordinary spike is necessitated by the hardness of the wood. The most objectionable feature seems to be the deep boxing of the tie, but it is does not seem to have given much trouble in Europe. The canting of the rail seems to us a wholly superfluous thing, although it is not likely to do harm, and has one real advantage, that it gives the rail a better chance to resist overturning by gradually cutting under the outer edge. We have seen rails canted outward 30° to 40° in yards where they had much wear but little fast running to make them dangerous, the wear going on at the same time so as to keep the top level. This peculiar mode of wear, by the way, explains the appearance of many rails which look as if they had been worn "by coned wheels," when in reality coning had nothing to do with it.

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

Buffalo, Rochester & Pittsburg.—Contractors, Ryan & McDonald, of Baltimore, are pushing work on the branch of the Lincoln & Charlotte Park road, running from a point on the main line near Barnard's crossing, N. Y., east to the river, about 1¼ miles. Tracklaying on the main line will soon be completed and the road opened for traffic. WM. E. HOYT, of Rochester, N. Y., is Chief Engineer.

Central Vermont.—Surveys have been commenced for the branch from Waterbury to Stowe, Vt., a distance of about 8 miles.

Chicago & West Michigan.—Fitzgerald & Co., of Lincoln, Neb., who have the contract for building the extension from Baldwin to Traverse, Mich., 74 miles, will sublet the contract in sections of 10 miles each. Applications should be addressed to John Fitzgerald & Bro., Grand Rapids, Mich.

Sandusky, Ashland & Coshocton.—Meetings are being held at the various towns along the route in interest of this road. The town of New London, O., voted $25,000 in cash, 6 miles right of way, and depot ground Clarksfield raised $7,000 and donated depot grounds. The road is to run from Sandusky, O., to Coshocton, O., a distance of 93 miles.

Elgin, Joliet & Eastern.—It is rumored that this company is considering the building of an extension from its present terminus at McCool, Ind., to Saginaw Mich., a distance of about 210 miles.

Brantford, Waterloo & Lake Erie.—Tracklaying has commenced on this road. It is stated that negotiations have been completed by which the road will be transferred to the Michigan Central R. R. Co. It will, however, be controlled by the present company until completed to Toronto, Ont. The road is projected to run from Waterford, Ont., to Toronto, about 80 miles. J. J. HAWKINS, of Brantford, Ont., is Secretary.

Maine Central.—Tracklaying on the line from Fabyan's to Scotts, N. H., 10 miles, has been completed to the Carroll township line.

Shepaug, Litchfield & Northern.—The $20,000 required to build the 4-mile branch from New Preston, on the main line, to Lake Waramaug, Conn., has been nearly all raised and work on construction will begin immediately.

Canadian Pacific.—Tracklaying on the Ontario & Quebec R. R. from London to Windsor, Ont., 112 miles, has been completed from London west, 20 miles.

Toledo, Columbus & Springfield.—The organization of the Toledo, Findlay & Springfield R. R. Co. has been completed with the election of the following officers: W. T. WALKER, President, and H. A. BROWN, Secretary and Treasurer. The road is projected to run from Toledo to Springfield, O., about 90 miles. The line will be completed from Bowling Green to North Baltimore, 15 miles, immediately; and as soon as that is completed, work will commence at Findlay and be pushed both ways.

Evansville & Terre Haute.—R. P. McCormick & Co., of Kansas City, Mo., have completed the 900-ft. tunnel for the Evansville & Richmond R. R. at Indian Springs, Martin county, Ind. About ¼ of the distance was limestone rock and the remainder soap-stone. The work was done with Ingersoll machinery. Work was commenced April 6, 1889, and the tunnel completed, ready for the track July 30.

Cincinnati, Washington & Baltimore.—All the property of this company of every kind and description will be sold at foreclosure on Aug. 19, 1889. This is part of the new plan of reorganization by which all property of the company is to be purchased at foreclosure by the trustees, who will organize a new company.

Central (New Brunswick).—This road has been nearly completed from Norton to Chipman, N. B., 44 miles, and application will soon be made to the Dominion authorities for permission to open the line for traffic.

Cape Breton.—About 2,000 men are now at work on this road between the Straits of Canso and Sydney. The road is to run from Point Tupper to North Sydney, N. B., 98 miles.

Pennsylvania.—It is announced that the $100,000 necessary to secure the extension of the Downingtown & Lancaster R. R. from New Holland to Lancaster, Pa., 11 miles, has been raised. Surveys are now in progress

Lancaster and Hamden.—Mr. J. A. PRITCHARD wishes us to make the following corrections to his statements concerning this enterprise in ENGINEERING NEWS, of July 6. He wishes to say only that the preliminary estimates were too low; at the time of letting the contract, no cross section work had been done. His statement that the enterprise is a failure because of its terminal points, he also desires to correct, saying that he referred only to Bloomingville, to which the contract was let, a small town of 200 inhabitants. He says further: "As for a road between Lancaster and Hamden, properly built, I believe it would pay well, as they are both booming towns, especially Lancaster, which has an abundance of natural gas." The references given by Chief Contractor BUELL, in our issue of July 20, he says, are all reliable men, and most of them men of money. He states that he was in the company's employ from May 23, 1887 till Jan. 1, 1888, and can furnish satisfactory explanations to any one interested of the severance of his relation at the latter date.

Lake Shore.—Work is in progress leveling up the road bed and laying the cross-ties preparatory to the early commencement of tracklaying. The road is to run from Alton Bay to Laconia, N. H., a distance of 15 miles.

New York & Ohio.—D. M. YOUMANS, President, is reported as saying that this company has disposed of its bonds and will now go ahead with the work. The road is to run from Hudson, O., to Greenville, Pa., 75 miles.

Projects and Surveys.

New York, Fort Wayne & Chicago.—Incorporated in Indiana to build a line of railway from Fort Wayne, Ind. to Chicago, Ill., a distance of 134 miles. JOHN LEE, of Crawfordsville, Ind., is President.

Buena Vista.—Incorporated in New Jersey to build a line of railway from a point on the New Jersey Southern R. R. to the village of Buena Vista, a distance of one mile.

Lansing & Northwestern.—The preliminary surveys for this proposed Michigan road have been commenced under the direction of QUINCY A. THOMAS, of Oxford, Mich., Chief Engineer. The road is projected to run from Lansing, Mich., north, via Maple Rapids and St. Johns to a point on the lake.

St. Louis & Lima.—A press dispatch from Crawfordsville, Ind., states that a project is on foot to build a line of railway from St. Louis, Mo., via Crawfordsville, Thornton, Tipton, and Hartford, to Lima, O. Col. JOHN LEE, of Crawfordsville, is at the head of the enterprise.

SOUTHERN.—Existing Roads.

Louisville Southern.—A company is being organized to build a railroad from New Castle to Shelbyville, Ky. to connect with this road.

Henderson State Line.—The magistrates of Henderson County, Ky., have decided to hold an election, Sept. 2, to find out the will of the people as regards the raising of the $75,000 subscription by Henderson precinct, No. 5, and $13,000 by Hubbardsville precinct, No. 6, as proposed by this company for the purpose of building a railroad through those points.

Owensboro, Falls of Rough & Green River.—Contractors Shafer and Nichols, Owensboro, Ky., propose to increase their force of workmen at that point by 100 men.

Columbus Southern.—The grading on this road from Columbus to Albany, Ga., 87 miles, is finished, and tracklaying is being pushed rapidly.

Augusta, Tallahassee & Gulf.—We are informed by the senior partner of the contracting firm of R. P. McCormick & Co., Kansas City, that they have the contract for building this road from Augusta, Ga., via Tallahassee, Fla., to the Gulf of Mexico, about 350 miles, and that work is now under way.

Savannah, Florida & Western.—The general passenger office of this company has been removed from Savannah, Ga., to Jacksonville, Fla.—Rapid progress has been made during the last few weeks in laying new 70 lb. steel rails. Ten miles have already been laid, and the work is to be pushed on to Jesup and thence to Jacksonville, Fla.

Savannah, Americus & Montgomery.—Reports from Montgomery County, Ga., state that 300 men are at work near the Ohoopee river, and that the grading is rapidly progressing.

Central R. R. of Ga.—Contracts for the construction of the Savannah & Western R. R. have been let as far west as Stirling, Ga., 70 miles. The section between Eden & Morrison has been completed, and J. F. Millen, the contractor, has been awarded another section of 15 miles from Ohoopee on the Ohoopee river to Stirling, and his entire force is now at work between those points. Chief Engineer DABNEY is now in consultation with contractors for the purpose of letting the contracts for the bridge work between the Ogeechee river and Stirling.

Georgia Southern & Florida.—The Georgia senate has passed a bill to amend the charter of this company by authorizing it to indorse the bonds of the Macon & Birmingham R. R. Co.

Western & Atlantic.—At present the topic for discussion in the Georgia legislature is the bill providing for the leasing of this road, mentioned in the columns of our last issue. There seems to be a great difference of opinion on the subject of the betterments claimed by the present lessees. The latest reports indicate that the bill will be passed.

Atlanta & Florida.—The citizens of Thomasville, Ga., are desirous of having this road extended to Tifton instead of Cordele, as at present proposed.

Alabama Midland.—The Alabama supreme court has dissolved the injunction obtained by the Central R. R. Co. of Ga., preventing this road from entering Troy by the original survey, and work is again in progress. Reports from Montgomery, Ala., state that over 2,100 men are now employed on the line, and that trains will be running into Troy by Nov. 1 Track has been laid from Bainbridge, Ala., 90 miles, the total length of the road being 175 miles.

East Tennessee, Virginia & Georgia.—Aldrich, Worthington & Co. have the contract for grading the Brierfield, Bloeton & Birmingham branch from Brierfield to Bessemer. The contract for the remainder, between Bessemer and Birmingham, will be let shortly.

Florida Midland.—Reports from Orlando, Fla., state that work will speedily be resumed on the extension of the road into Kissimmee. Track has been laid as far as Harperville, and trains are running to Windermere.

Florida Southern.—A third rail has been laid between Palatka & Gainesville, Fla., which the knowing ones state is to be used by the Savannah, Florida & Western R. R. in running through cars to Gainesville in opposition to the Georgia, Southern & Florida R. R.

Jacksonville & St. Augustine.—The mile of new railroad between the tracks of this company, and the railroad bridge, at Jacksonville, Fla., has been completed.

Midland of North Carolina.—The town commissioners of Winston, N. C., decided last week not to issue the bonds of this road to the Richmond & Danville R. R. Co., as had been proposed.

Wilmington, Onslow & East Carolina.—Reports

from Wilmington, N. C., state that the work of grading is steadily progressing on this road, which is to run from Wilmington, northeast 50 miles.

Columbia, Newberry & Laurens.—At a recent meeting of the stockholders of this company, held in Columbia, S. C., the directors were instructed to have the iron bridge over the Broad river constructed on the present piers, and to continue the road from Newberry to Spartanburg.

Georgia, Carolina & Northern.—Grading has been resumed at Chester, N. C. Contracts for grading 50 miles west from Chester were let on the 27th inst., and more will be given out in September.

The following are the contractors beginning at Chester and going westward; Robert Hallyburton, Chester, S. C., 6 miles; Stewart Sullivan & Co., Chester, S. C., 3 miles; C. D. Langhorne, Richmond, Va., 5 miles; Murdock & Calvin, Columbia, S. C., masonry at Broad river; M. J. Condon & Co., Knoxville, Tenn., 10 miles; Greystone Granite and Construction Co, Raleigh, N. C, 3 miles; L. Wright & Co., Richmond, Va., 8 miles; Griffith & Linberger, Memphis, Tenn., 6 miles; S. Holshouser & Co., Clinton, S. C., 4 miles; A. & C. Wright, Rusk, N. C., 5 miles. These contracts take the line 5 miles beyond Clinton, S. C.

Eutawville.—It is reported that work on this South Carolina road is being rapidly pushed by President BARKLEY, and that it will be completed to Sumter in a very short time. The company has already let the contracts for the buildings, depots, car sheds, etc., in Sumter. Tracklaying will begin immediately upon the completion of the grading, and 1000 tons of rails are now on their way to Charleston for that purpose. It is stated that the name will be changed to Charleston, Sumter & Cheraw R. R. when the whole road is put into active operation which will be about Oct. 1.

South Carolina.—The superstructure of the draw bridge over the Wateree river, South Carolina, is practically completed, but the foundation for the pivot pier has as yet not been begun. It is supposed that the company is waiting for low water, as in that case the cost of construction would be reduced at least one half.

Farmville & Powhatan.—During the past week this company purchased at auction for $200,000 cash the Brighthope R. R., which runs from Bermuda Hundred, Va., to Eppes' Falls. The sale was made because of default in the payment of interest due upon its bonds.

Norfolk & Western.—It is announced that this company is about to consolidate with some of its auxiliaries, including the Norfolk Terminal Co., and that it intends to create a consolidated mortgage upon its existing lines, being a first mortgage upon the Norfolk Terminal R.R., and the Ohio and North Carolina extensions about to be constructed.

Roanoke & Southern.—Hon. H. S. TROUT, president of this company, in a recent interview stated that $150,000 has been subscribed, and that work will begin on the Roanoke end of the line next April.

Ohio River.—The citizens of Roane county, W. Va., have subscribed $31,000 for the proposed railroad to extend from Spencer to a junction with this road at Ravenswood.

West Virginia Central.—The first passenger train will run from Cumberland to Elkins, W. Va., 126 miles, on Aug. 12. The total extent of main line and branches thus far completed is 130 miles.

Tennessee & Ohio.—This road has been purchased by the East Tennessee, Virginia & Georgia R. R. Co., and will be extended to Big Stone Gap, Va., 45 miles.

Louisville, Hardinsburg & Western.—Judge N. MCMERCER, Hardinsburg, Ky., last week filed at Hartford, Ky., the $630,000 mortgage on the entire property of this company, drawn to the American Loan and Trust Company, of New York City. The line will run from Lexington to Fordsville, 37 miles, and it is proposed to extend it in the near future to Hartford, and thence to Mt. Henry to connect with the Chesapeake, Ohio & Southwestern R. R.

Projects and Surveys.

Missouri, Tennessee & Georgia.—We have received the following information from L. B. WRIGHT, of Humboldt, Tenn., President:

The road is projected to run from Kansas City, Mo., to Savannah, Ga., forming a through line between those places. About 85 miles of the road from Humboldt to the Mississippi river are now under survey and right of way has been secured. The road can be cheaply constructed and will pass through a fertile section of the country. The principal business of the road will be in farm produce, timber, coal, and minerals. About $250,000 local aid has been secured in money, lands, and bonds. The company was incorporated in March, 1889. J. J. WILLIAMS, of Jackson, Tenn., is Chief Engineer.

Staunton & West Augusta.—We have received the following information from the firm of Hill & Stout, 42 Broadway, New York, engineers of this road:

The road is to run from Staunton, Va., via Churchville and Stribling Springs, to the Dora coal fields in North River Gap, a distance of 25 miles. The preliminary surveys were completed July 22, 1889. There will be four heavy summit cuts and considerable rock work; maximum grade, 2 per cent. The principal business will be in anthracite coal from the Dora coal fields, timber, bark, and live stock. About one-half of the right of way has been obtained. The company was incorporated in 1889. R. N. POOL, of Staunton, is President.

Shelby & Western.—Chartered in Alabama to build a line of railway from Shelby to Calera, Ala., a distance of 11 miles. Among the incorporators are: NEWTON CASE and LUCIUS A. BARBOUR, of Hartford, Conn.; J. ANDREW PICKETT, of New Britain, Conn., and HOMER R STOUGHTON, of Shelby county, Ala.

Shelby & Alabama Central.—Incorporated in Alabama to build a railway from Columbiana to Sylacauga, Ala., about 28 miles. The incorporators are the same as those of the Shelby & Western R. R. Co.

Richmond County Belt.—The incorporators of this Georgia company, a bill for the incorporation of which was noted in our last issue as introduced into the Georgia State Legislature, are CHARLES A. ROBBE, THOMAS MURRAY, and A. J. O'CONNOR.

Alabama, Georgia & Florida.—The engineers of this road have completed the surveys from Columbus to Bainbridge, Ga., and are now working toward Quincy, Fla. C. G. JORDAN, of Columbus, Ga., is interested.

Yadkin.—This company is reported to have let the contract for building its proposed road to the Greenville Construction Co. The road is projected to run from Salisbury, Rowan County, N. C. to Norwood, Stanly County, N. C., a distance of about 35 miles.

Tampa & Chicago Air Line.—Press dispatches state that a project is being agitated to build a railway from Tampa, Fla., to Chicago, Ill.

Macon & Birmingham.—The surveys for this road, which is to run from Macon, Ga., to Birmingham, Ala., are nearly completed. W. H. WELLS, of Macon, is Chief Engineer.

Tampa & West Coast.—Capt. E. B. CARTER Chief Engineer, has completed the surveys for this road. The road is to run from Tampa, Fla., west to the Gulf coast, a distance of 21.8 miles.

Rome & Gainesville.—It is rumored that a railroad is to be built from Rome, Ga., through Adairsville, connecting with this road near Gainesville. The route runs through a fine mineral and agricultural district.

Mobile, Jackson & Kansas City.—Chief Engineer J. W. NICOL, has made his final report on the work of locating this road. It is to run from Mobile, Ala., northwest, to the Pascagoula river, near the junction of the Chicasahay and Leaf rivers, and from there is chiefly a valley route on to Jackson, or Brandon, Miss. The length is 182.5 miles, and the estimated cost per mile $12,671.09. The officers are F. A. LULING, President; H. A. AUSTIL, Vice-President; R. B. OWEN, Secretary.

Bowling Green & Northern.—At a meeting of the directors held last week at Bowling Green, Ky., the following officers were elected: President, Ex-Gov. PROCTOR KNOTT; Vice-President, J. D. HINES; Treasurer, C. M. MCELROY; Secretary, M. H. CRUMP. The indications point towards beginning work shortly.

NORTHWEST.—Existing Roads.

Chicago & Northwestern.—The annual report of this company, for the year ending May 31, 1889, gives the following results of operations:

Gross earnings	$25,692,258
Operating expenses and taxes	16,027,287
Net earnings	$9,664,971

This result shows a decrease in net earnings of $687,088 from the previous year. President HUGHITT attributes the decrease in revenues principally to adverse legislation. He says, in his review of the year's business: "Besides the effects which have necessarily been experienced from the continued operation of the Interstate commerce law in its general application to the traffic moved upon our lines, there has been a State legislation and imposition of rates to diminish the revenues." He claims not only that in many cases the rates established have been less than the actual cost of performing the service, but the company has been compelled by the courts, under the penalty of fine and imprisonment, to perform such services where the undisputed records showed that a loss was taking place. He also adverts to rate wars as another cause for diminution in earnings, but thinks that the Interstate Railway Association will ultimately prove a remedy for this evil.

Pacific Short Line.—This company has placed an order for 10,000 tons of rails with the Bethlehem iron works of Pennsylvania. It is expected that tracklaying will commence about Sept. 1.

Chicago, Peoria & St. Louis.—This company has made a mortgage of $1,800,000 in favor of the Central Trust Co., of New York. The money is to be used in retiring the outstanding bonds, in purchasing additional equipment, and in constructing and acquiring additional railways. The mortgage applies only to the lines from Pekin to Jacksonville, Ill., and from Peoria to Springfield, Ill., an additional sum of $15,000 per mile being obtained for all road constructed or acquired in the future.

Green Bay, Winona & St. Paul. — A plan of reorganization of this company has been issued by which the income bonds are to be assessed 10 per cent., the preferred stock, 5 per cent., and the common stock 5 per cent. The reason for the assessment is that the company is unable to meet the interest charges of the large floating debt. The plan also proposes to build the extension from Winona to Omaha.

Manitoba & Northwestern.—Reports are in circulation that this road has been purchased by both the Northern Pacific and Canadian Pacific railway companies. The road runs from Portage la Prairie, Man., northwest a distance of about 200 miles.

Winnipeg Transfer.—Work has been commenced on this road by Contractor Buchanan.

Milwaukee & Northern.—It is stated that this company will build a line of railway from Escanaba, Mich., to Iron Mountain, a distance of about 75 miles. The object of the road is to obtain an independent line to the mines.

Winona & Southwestern.—Arrangements have been made for placing this company's bonds and it is expected that work will commence soon. The line has been surveyed from Bear Creek Station to Mason City, Ia., 117 miles. There will be considerable heavy work on this division.

Pacific Short Line.—It is reported that grading has been completed from Sioux City, Ia. to Plainview, Neb. Bridge work is now being pushed and it is intended to have this section ready for tracklaying by Sept. 1.

Projects and Surveys.

Northwestern Junction & Lake of the Woods.—ALEX. MUTCHMOR, 104 Sparks Street, Ottawa, Ont., General Agent, sends us the following information concerning this enterprise:

The road is projected to run from Portage la Prairie to Emerson, Man., thence direct to Lake of the Woods, a distance of 175 miles, passing through a fertile prairie region the entire distance, and penetrating a large tract of timber land at Lake of the Woods. Work will be light. The company expects a land grant from the Dominion Government. No surveying has been done, nor organization effected.

Lake Superior & Southwestern.—We are indebted to C. D. BELDEN, of Austin, Minn., secretary, for the following information:

The line is to run from some point on Lake Superior, via Rochester, Brownsdale, Austin, Minn., Northwood, Ia., to Omaha, Neb. Sixty miles from Rochester to Northwood are now under survey. The road will run through a prairie country affording easy grades and curves. The principal sources of traffic will be coal, lumber and grain. The company was incorporated July 19, 1887. The officers are ANDREW NELSON, of Rochester, Minn., President; B. F. BACON, of Brownsdale, Minn., Vice-President; C. D. BELDEN, of Austin, Minn., Secretary; and E. DAMON, of Red Wing, Minn., Treasurer.

Port Arthur, Duluth & Southwestern.—Subsidies amounting to $7,200 per mile for the first 40 miles of this road from Port Arthur southwest have been secured. It is also stated that other capital has been obtained and that the first 40 miles will be completed this year.

Forest City Southeastern.—It is announced that contracts have been let for grading this road from Forest City to Gettysburg, 16 miles. The road is to be completed by Oct 1.

Itasca Lumber Co.—This company will build a logging road from Itasca, Minn., northwest to its lumber camps in the Pillsbury timber district, a distance of about 30 miles. The road will be used as a logging road only for the present, but will be built standard gauge and in a permanent manner looking toward a general freight and passenger business in the future.

Omaha, Lincoln & Gulf.—Incorporated in Nebraska to build a line of railway from Omaha, Neb., to Bryerton, Tex., a distance of about 1,200 miles. Among the incorporators are GEO. L. RHOCHS and M. P. O'BRIEN.

SOUTHWEST.—Existing Roads.

Louisiana, Arkansas & Missouri.—We have received the following information from HARRY H. MYERS, of Brinkley, Ark., Assistant Secretary:

The road is projected to run from Alexandria, La., to Brinkley, Ark., 200 miles. Surveys have been completed and the contract let for that portion of the line between Delhi, La., and Trippe, Ark. The route is through a level, heavily timbered country, affording easy grades and curves. The principal business of the road will be in cotton, timber, and farm produce. The entire right of way has been secured, and a considerable amount of other local aid obtained. The Fruin-Bambrick Construction Co., of St. Louis, Mo., has the contract for building the line from Delhi to Trippe, 80 miles, and work is now in progress. This portion of the road is to be completed by October 1. The company was incorporated in January, 1887. H. M. HOYT, of 58 William St., New York, is President, and W. C. AGNEW, of Youngstown, O., is Chief Engineer. H. D. WELLS, of Delhi, La., is interested in the enterprise.

Chicago, Kansas City & Texas.—The Winner Investment Co. has completed its dummy line from Harlem, opposite Kansas City, Mo., to Linden, 10 miles north, and trains are now running. It is stated that another line will be built by the same company, from a point on the main line at Randolph Bluff, to Reed Springs and Liberty, Mo. The road is to be completed this season.

Helena & Brinkley.—A press dispatch from Helena, Ark., states that work is progressing favorably on this road from Brinkley to Pine City on the Arkansas Midland R. R. About 100 men are now at work grading, and track is being laid as fast as possible. It is expected that the road will be in operation within three months.

Missouri Pacific.—Rumors are in circulation that this company is considering the extension of the Bagnell branch to Lebanon, Mo.

Arkansas Midland.—A mortgage of $300,000 has been given by this company to ALBERT COLLINS, of New York, secured on the main line from Helena to Clarendon, Ark., 48 miles, and all other property of the com-

pany. An increase of $6,000 per mile for every mile of proposed branches and extensions will be secured. The money will be used in equipping and extending the road and building the proposed branches to Indian Bay and Old Town Ridge, 18 and 12 miles respectively.

Atchison, Topeka & Santa Fé.—A press dispatch from Albuquerque, N. M., states that engineers have been ordered to make the surveys for a railway from Algodones, N. M., to the San Pedro mining camps.

New Orleans, Fort Jackson & Grand Isle.—About 14 miles of this road has been graded ready for the rails. It is expected to have the road completed to the Socola canal by December. H. C. WARMOTH is now in the north negotiating for locomotives and cars.

Houston, Central Arkansas & Northern.—Track-laying on the northern division of this road from Anachita, La., to Prairie Mer Rouge, is in progress. The lower division of 25 miles is already completed. The road is projected to run from Monroe, La., via Pine Bluff to Little Rock, Ark. It is being built by the Reynolds & Henry Construction Co. JAS. B. GREEN, of Monroe, La., is Superintendent.

Santa Fé & Southern.—Surveys for the extension of this road to the South Santa Fé mining camps will be made soon. The extension will be about 50 miles in length, about one-half of which is across the Santa Fé valley, where construction is very cheap. The road now runs from Santa Fé to Espanola, N. M., a distance of 40 miles.

Projects and Surveys.

New Orleans, Natchez & Ft. Scott.—H. A. NAFF, of Bastrop, La., Secretary of the North Louisiana & Arkansas R. R. Co., sends us the following information concerning that enterprise:

The North Louisiana & Arkansas R. R. Co. was incorporated to build a railway from Rayville, La., north to the Arkansas State line, via Oak Ridge, La. The company will be consolidated with the New Orleans, Natchez & Fort Scott R. R. Co., which has completed surveys for a road to run from Natchez, Miss., to Rayville, La. The length of the two roads will be about 104 miles. The route is through a comparatively level country, affording very easy grades and curves. The principal business of the road will be in cotton, lumber, cattle, and farm produce. About one-half the right of way has been secured and the remainder has been guaranteed. A five-mill tax has been voted in aid of the road by the parish and town of Bastrop and donations in cash of $34,000 obtained. The contract for the line from Natchez to Rayville will be let about Sept. 1, and from Rayville to the Arkansas State line about Jan. 1, 1891. The officers of the company are AUGUSTUS HEFNER, of Oak Ridge, La., President, and H. A. NAFF, of Bastrop, La., Secretary.

Galena, Guthrie & Gulf.—Incorporated in Kansas to build a railway from Baxter Springs, Kan., south through Oklahoma and the Indian Territory to the Gulf of Mexico, a distance of about 210 miles. The headquarters of the company will be at Baxter Springs.

Lampasas, Burnet & Southwestern.—We are indebted to H. L. HIGDON, of Lampasas, Tex., Chief Engineer for the following:

The company was organized in Jan., 1889, with L. W. GALBRAMTH, of Lampasas, President. Two lines have been surveyed, from Lampasas to Burnet and from Lampasas to a point about 5 miles east of Burnet. The maximum grade is 1½ per cent. and the maximum curve is 4 deg. The length of both lines is about 23 miles. The route is through a fine farming country and will have a large traffic in wool, live stock, and farm produce. Subsidiers to the amount of $400,000 have been secured. Negotiations are now in progress looking to the early completion of the road.

Kansas City & Warrensburg.—A project is on foot to build a dummy railway from Kansas City to Warrensburg, Mo.

Cattle Trail.—STANLY M. JONES, of Baird, Callihan county, Tex., Chief Engineer, has given us the following data:

The organization of this company has not been completed, all business yet being in the hands of an executive committee. The road is projected to run from Doan's store, on the Red river, in Wilbarger county, Tex., South via Brady, McCulloch county, to Eagle Pass, on the Rio Grande, where it will make connections with the Mexican International R. R. Surveys have been completed from Doan's Store to Brady, a distance of 240 miles. This portion of the line will afford very light work, the excavation and embankment not amounting to over 7,000 cu. yds. per mile. Surveys on the line from Brady south will commence soon. Right of way for the entire line has been secured and subsidies amounting to $400,000 obtained. It is expected that the road would have a large live stock business from Mexico and western Texas.

Sherman Belt.—A company is being formed to build a belt line transfer railway around the city of Sherman, Tex. GEO. W. MARSHALL, of Sherman, is interested.

Kansas City & Excelsior Springs.—Work securing the right of way for this road, which is projected to run from Missouri City to Excelsior, Mo., about 9 miles, is in progress. Hammet, Davison & Co., Bankers, of Kansas City, Mo., are interested.

ROCKY MT. AND PACIFIC.—Existing Roads.

Southern Pacific.—It is announced that this company has purchased 30,000 tons of steel rails, which will be used on proposed extensions in California. It is the intention of the company to build about 337 miles during the present season. Of the proposed mileage, 129 miles will be in San Luis Obispo and Santa Barbara counties, and the remainder in the San Joaquin Valley. Two lines will be completed in the San Joaquin Valley running from Oakdale, Stanislaus county, to Sanger in Fresno county, 108 miles, and from Tracy, San Joaquin county, southward and west of Fresno city to Armona, in Tulare county and thence to Bakersfield. The new track in San Luis Obispo and Santa Barbara counties will connect the Coast division with the Newhall extension.

Spokane Falls & Northern.—About 30 miles of track has been laid on this road and 70 miles graded. The road is to run from Spokane Falls, W. T., via Coville and Columbia, to Little Dalles, W. T., about 175 miles. D. C. CORBIN, of Spokane Falls, is the contractor.

Seattle, Lake Shore & Eastern.—The contract for clearing the right of way for 15 miles of this road from the International boundary south has been let to EDWIN H. WARNER. A large force of men has been forwarded to the scene of operations, and work will commence at once. Only two miles more of the line is to be surveyed to complete the final location from Seattle to the boundary line.

San Diego, Cuyamaca & Eastern.—Good progress is being made on the construction of this road from San Diego east. The report that this road will build to Yuma, Arizona, to connect with a line from that place to Deming, N. M., is denied by an official of the company.

Oregon Pacific.—The location of this line has been completed from Deschuttes to the Snake river. About 100 men are now at work on the 30 miles let to Antonelle & Doe. Further contracts will be let soon.

Union Pacific.—The sale of the Denver, South Park & Pacific R. R. has given rise to rumors that it will be extended to the San Juan and the Aspen and Glenwood Springs region. Vice-President HOLCOMB is quoted as saying that the announcement that the contract for building the Cheyenne & Northern R. R. had been let was premature, but if earnings kept on as expected, the line would probably be built this season.

Projects and Surveys.

Siuslaw & Eastern.—A press dispatch from Eugene City, Ore., states that a party of engineers has left that place to begin surveys on this proposed road. The road is projected to run from Siuslaw, via Eugene City, to the eastern boundary of Oregon. A. G. HOVEY, of Eugene City, is President.

Puget Sound Shore.—A railway company by this name has been incorporated in Washington Territory to build a railway from a point near the junction of the Green and White rivers through the Stampede pass of the Cascade mountains to Seattle, W. T. Among the incorporators are A. A. DENNY, CHAS. F. MUNDAY, and EDW. L. TERRY.

Albany & Astoria.—W. B. BARR, City Engineer of Albany, Ore., has commenced the locating survey of this road, which is projected to run from Astoria to Albany, Ore.

Ellensburg & Northeastern.—V. C. LLOYD, of Ellensburg, W. T., Secretary, sends us the following information:

The surveys have been completed on this road which is to run from Ellensburg to Port Eaton, on the Columbia river, a distance of 40 miles. About ⅔ of the line is mountain work. All the right of way has been secured and a subsidy of $75,000 from the city of Ellensburg obtained. The contract for construction will be let within two weeks. It is expected tracklaying will commence about May, 1890 and the road be completed by the following February. JOHN A. SHOUDY is President.

RAPID TRANSIT.

Electric Railways.—***Buffalo, N. Y.***—The Citizens' Electric Street Ry. Co., has modified its route and again applied for a franchise.

Jersey City, N. J.—The Jersey City & Bergen Street Ry. Co. has applied for power to operate its lines by electricity; it will use a storage battery system.

Newark, N. J.—The Essex Passenger Ry. Co. has applied for power to operate its lines in the city and suburbs, about 65 miles, by electricity. An overhead wire system will be used.

Nashville, Tenn.—The McGavock & Mt. Vernon Street Ry. Co. has been receiving proposals for the extension of its electric plant, and will equip all the lines of its system for electric traction.

Augusta, Ga.—The Railway Committee has recommended the City Council to grant the application of the Street Ry Co. for power to operate its line by electricity.

Belleville, Ill.—The Citizens' Street Ry. Co. has applied for power to adopt an electric system.

St. Paul, Minn.—The street railway company made a proposition to extend the proposed electric lines to West St. Paul if a bonus is granted by the city.

Kansas City, Mo.—The Northeast Ry. Co. has been organized to build an electric railway, 3½ miles long, including the Independence horse-car line which has been purchased from the Metropolitan Co. The Thomson-Houston system will be used. There will be engines of 300 H. P., 3 dynamos of 80 H. P., 10 cars equipped with 2 motors of 15 H. P. each. It will be double track and will have some trestle work. Mr. W. B. KNIGHT, C. E., has taken the contract to build and equip the line for $250,000, and have it completed by January, 1890. President, W. H. WINANTS; Vice-President and General Manager, E. A. PHILLIPS; Secretary, W. C. SCARRITT; Treasurer, J. H. NORTH; Chief Engineer, W. B. KNIGHT.

South Sioux City, Neb.—The South Sioux City Electric Ry. Co. has been organized. President, R. N. BOWLER, Des Moines, Ia.; Secretary, J. M. BROWN. Capital stock, $300,000.

Denver, Col.—The University Park electric line is to be opened in August. It will connect with one of the cable lines and through cars will be run.

Oakland, Cal.—The Oakland & Berkeley Rapid Transit Co. has been organized to build a line 12 miles long; an overhead electric system will be adopted. President, F. K. SHATTUCK; Treasurer, V. D. MOODY.

Street Railways.—***Albany, N. Y.***—The Albany Ry. Co. is laying its State St. line with the cast iron substructure of the Metallic St. Ry. Supply Co.'s system. Some of this track has been in service in Albany for over four years, and the results have been very satisfactory.

New York, N. Y.—The Jerome Ave. Ry. Co. has been incorporated to build a double track line 5 miles long on Jerome Ave., between Macomb's Dam bridge and Woodlawn Cemetery. Capital stock, $200,000. The incorporators are D. LOWBER SMITH, R. A. CUNNINGHAM, W. H. WHITNEY, J. ROMAINE BROWN, FRANK YORAN, MOSES MEHRBACH, H. CAMPBELL, J. H. SULLIVAN and JOHN WHALEN.

Roanoke, Va.—The contract for grading and tracklaying on the line from Commerce St. to Melrose Park has been awarded to McGinnis & Rogers. Contracts have not been let for the Vinton extension.

Washington, Ga.—The street railway company has been organized and will build the first line from the depot to the court-house. President, C. E. SMITH; Vice-President, BURWELL GREEN.

Macon, Ga.—The new street railway company has been organized as follows: President, GEO. F. WORK, Philadelphia, Pa.; Secretary and Treasurer, J. H. DEVOE, New York; Directors, HENRY HORNE, Macon; LOUIS E. PFEIFFER, Philadelphia; and JOHN J. MACFARLANE, Philadelphia; General Manager, E. E. WINTERS; Superintendent, M. BELL.

Toledo, O.—The Metropolitan Street Ry. Co. has sold its lines to a Chicago syndicate for about $235,000.

Charlton, Mo.—A street railway is to be built from the depot to the town.

Cable Railways.—***Allegheny, Pa.***—The Allegheny Traction Ry. Co. has been organized by GEO. B. HILL, J. H. DALZELL, JOSHUA RHODES, and J. D. NICHOLSON, of Allegheny; C. L. MAGEE and A. C. MCCALLUM, of Pittsburg; and J. A. MCDEVITT, of Lancaster. Capital stock, $350,000.

Kansas City, Mo.—The Kansas City Cable Co. will build an extension this year, of its East 9th St. division to Mt. Vernon, on the Kansas City & Independence Rapid Transit Ry.

Seattle, W. T.—The Lake Washington line, which was ruined at the time of the recent fire, is being rebuilt.

Oakland, Cal.—The Oakland & Piedmont cable line is now under construction beyond the city limits.

Steam Motors.—The Prosser combined motor and car is to be given a trial in St. Paul, Minn. It is carried on trucks and has 4 cylinders.

The Pullman Car Co. is building a compressed steam motor engine, on the Thomas system, and will try it on the street railway at Pullman, Ill.

HIGHWAYS.

Public Roads in Ohio.—"It has been said that the state of civilization of any section may be known by the condition of its highways. If judged by this, some citizens of Ohio could scarcely escape being classed as barbarians. I recently passed through that State, from the Indiana line to Cleveland, over some of the worst roads I ever encountered. The highways and byways were all a sea of mud from fence to fence; a little too thick for boating and not thick enough for mortar. The land in Lorain county is a dead level, the roads broad and flat, the gutters wide and shallow, so that teams cross, recross and "criss-cross" in all directions, vainly endeavoring to find a spot with a bottom to it. I saw only two loaded wagons, in an entire week, trying to effect a passage. One, with two teams, had on a medium-sized sawlog. In places the wheels sank nearly axle-deep, and threw up ridges of mud like furrows after a plow. The other load was about 500 weight of straw, and it careened from side to side like a sailboat in a choppy sea. The farms appeared good and well cultivated, and the landscape was dotted with substantial and even elegant farm-houses. This proud commonwealth is so noted for its great number of eminent statesmen and able agricultural writers it is a wonder that its people have to flounder through the mud for 6 months in the year. The roads cannot be made passable by individual effort; it must be done by the State. But I was assured the farmers would vote down any proposition to make passable roads by a State tax, although many of the best citizens are in favor of it. It is quite different in Indiana. There the State has turnpiked and graveled all the main roads. In a drive of a dozen miles in that State the carriage felloes were not covered with mud."—GALEN WILSON, Grant Co., Ind., in the *American Agriculturist*.

A correspondent writes us:

"What works on road-making, other than Gillespie's, would you recommend?"

Gillespie's book, though somewhat ancient, is still a good book on the subject of road making. Gilmore's "Roads, Streets, and Pavements" is a more recent book, but with little additional that is new; probably the best and most reliable information on the subject is a paper by E. P. NORTH, C. E., read before the American Society of Civil Engineers, April 16, 1877, entitled "The Construction and Maintenance of Roads," and for which the Norman medal was awarded the author. It was published in ENGINEERING NEWS, commencing July 12, 1879, and continuing through four successive numbers, but unless it can be bought from the American Society, it is unattainable, except to owners of ENGINEERING NEWS of 1879. The earlier volumes of ENGINEERING NEWS contain the most valuable contributions of the past decade on the subject of roads, streets, and pavements, published anywhere in English, and we are preparing an index of these papers for publication.

HUNTSVILLE, MADISON CO., ALA., July 24, 1889.

Enclosed find money order for advertisement, $10.80. It brought us many bids from distant localities. Madison County has awarded bids for 38 miles of turnpikes to Darnell, Lane & Co., of Greencastle, Ind., at an average of about $2,000 per mile. We expect to expend about $95,000 on turnpike roads during the next 12 months.

Yours respectfully,
THOMAS J. TAYLOR.
Judge Probate.

The advertisement referred to was for 73 miles of turnpike, published three times in June at an expense to the county of $10.80. Does any person imagine that the investment did not pay well in the increased competition?

Union County Highways.—The attention of contractors is called to another letting of highway improvement in Union County, N. J., advertised for the first time this week. The road runs parallel to the Central New Jersey Railroad, the entire distance as shown on our map on page XXII. (advertisements) in last week's issue.

We understand that about 60 contractors from mostly distant parts of the country have applied for specifications for these roads. Many contractors have looked the ground over, but in the one letting already opened there were so far as we have learned only four bidders. Engineer DUNHAM has drawn careful specifications and he means to have them carried out too; his reputation as an engineer is at stake in this matter, and we can assure contractors that the success of these roads in Union County means a large following in that and other counties of New Jersey, and probably in other States. Engineer DUNHAM is right and we trust he will give to Union county the best macadamized roads in America.

CONTRACTING.

Contractors Wanted.—A correspondent of July 31 writes us for "a list of addresses of leading contractors for public works who reside (or have an office) on the Atlantic seaboard. Must be responsible contractors of large means and ability, accustomed especially to construction on the seacoast, and excavation of rock in large quantities both on land and in water. They must be capable of undertaking a job of, say, $480,000 and furnishing necessary bonds to guarantee their bids."

[The above matter is urgent. We could select a dozen firms from the list we have now in preparation and send to our correspondent. But as we very well know the strict conditions under which the contract will be let and the care which will be exercised in the selection of a contractor, we have deemed it best to give the men or firms who consider themselves qualified and ready to do the work a chance to send us their names, which we expect will not be delayed later than Tuesday morning, Aug. 6.—PUB. ENG. NEWS.]

Building.—The contracts for a new building at the County Infirmary at Cincinnati, O., to cost about $14,000, have been let as follows: Carpenter work, to Phillips Brothers, of Carthage, for $2,447. Brick masonry, Julius Hesterberg, of Reading, for $2,847. Iron work, Kreiger, Burkhardt & Co., Cincinnati, $2,378.50. Slate, galvanized iron and tin work, L. W. Haley, Carthage, $753. Freestone work, Louis C. Buente, Cincinnati, $425. Limestone work, including foundation complete, Frey & Boehn, Carthage, $2,195. Excavation, Dill & Weisbrodt, Carthage, $570. Concrete and cement work, August Heilming, Carthage, $1,490. Painting and glazing, Oscar McCammon, Carthage, $432. Plumbing, J. R. Gibson Cincinnati, $92.22.

Levee Work.—Subcontractors wanted for 400,000 cu. yds. of new levee work in Illinois. John Mackler & Co., 321 Walnut St., St. Louis, Mo.

Paving.—The Docks Commissioners, New York City, have received the following proposals for removing the existing crosswalk, earth, etc., from the newly made land extending from Pier (old) 29, to Pier (new) 21, North river, and for paving the same with granite or Staten Island syenite blocks, and for laying crosswalks: Charles Guidet, $33,581.79; Matthew Baird, $34,000; Bernard Mahon, $34,500; Charles C. Cotte, $34,993; Joseph Moore, $35,000. The contract was awarded to Charles Guidet.

Sewer Pipe.—The following were the proposals received by the City Clerk, Syracuse, N. Y., for furnishing and delivering cement sewer pipe at Burnet Park: Martin & Sullivan, $2,400.50; Central City Pipe Works, $2,406.88.

Natural Gas Plant.—The Bluffton Light & Fuel Co., of Bluffton, Ind., has awarded the following contract for screw bolts, drift bolts, spikes, washers and chain or cable, 4 cts. per lb., including the boring of necessary holes; rubble stone for revetment, refilling and embankment, $1 per cu. yd.; drawing piles, $1.25 each; redriving piles, 75 cts. each; waling timbers, 32 cts. per lin. ft.; dredging and placing stone, $1 per cu. yd.; driving piles back to position, 75 cts. each; taking off and replacing waling timber, 32 cts. per lin. ft.

Brick, Stone and Lumber.—The following proposals for material for the Congressional Library building have been received by BERNARD R. GREEN, Engineer and Superintendent, Washington, D. C. Brick: Washington Brick Machine Co., $9.49 per 1,000; A Richard & Co., Washington, $9.50. The contract was awarded to the Washington Brick Machine Co. Stone (granite templates, skewbacks and bond stones): Brandywine Granite Co., Wilmington, Del., $5,405.24; McClenahan & Bro., Port Deposit, Md., $5,560; Guilford & Watersville Granite Co., Baltimore, Md. $6,386; Berry & McFredrick, Baltimore, $6,400; Washington Granite Monumental Co., Washington, $6,943.43; Cape Ann Granite Co., Boston, Mass., $6,950; Mt. Waldo Granite Works, Frankfort, Me., $6,993; Bodwell Granite Co., Rockland, Me., $8,935. The

Dikes.—The following proposals for dikes in Winyaw bay, S. C., were opened July 24 by Capt. W. H. BIXBY, U. S. Engineer Office, Wilmington, N. C.

Items.	Quantities.	John Shehan, New Rochelle, N. Y.		Colin McK. Grant, Charleston, S. C.		Wm. H. Morton, New York, N. Y.		J. G. Howell, New York, N. Y.		Wm. T. Gaynor, Fayetteville, N. Y.		Roderick G. Ross Wilmington, N. C.		Southern Construction & Quarry Co. Nashville, Tenn.	
		Price	Amount	Price	Amount	Price	Amount	Price	Amount	Price	Amount	Price	Amount	Price	Amount
Sheet piling in place on shore	120,000 ft. B.M.	$45.00	$5,400	$32.20	$3,864	$30.00	$3,600	$45.50	$5,460.00	$40.00	$4,800.00	$35.00	$4,200.00	$65 10	$7,812.00
" " seaward	360,000 "	40.00	14,400	36.20	13,032	32.00	11,520	45.50	16,380.00	70.00	25,200'00	55.00	19,800.00	62.40	22,464.00
Oyster shell " on shore	500 cu. yds.	2.50	1,250	1.35	675	2.50	1,250	.67½	337.50	1.35	675.00	1.47	735.00	1.50	750.00
" " seaward	1,500 "	2.00	3,000	1.29	1,935	2.50	3,750	.67½	967.50	1.43	2,145.00	1.57	2,355.00	1.45	2,175.00
Small stone " on shore	1,000 tons	3.50	3,500	3 34	3,340	2.50	2,500	2.74	2,740.00	3.10	3,100.00	2.77	2,770.00	2.47	2,470.00
" " seaward	15,000 "	3 00	45,000	3.22	48,300	2.50	37,500	2.74	41,100.00	2.45	36,750.00	2.57	38,550.00	2.49	37,350.00
Large stone " on shore	2,000 "	3.50	7,000	6.15	12,300	2 50	5,000	3.07	6,140.00	3.95	7,900.00	3.50	7,000.00	3.40	6,800.00
" " seaward	3,000 "	3.00	9,000	5.95	17,850	2.50	7,500	.57	9,210.00	3.10	9,300.00	3.25	9,750.00	3.45	10,350.00
Mattresses " in the work	25,000 sq. yds.	6.00	150,000	.85	21,250	1.49	37,250	3.07	14,250.00	.98	24,500.00	.95	23,750.00	1.00	25,000.00
			248,550		122,546		109,870		96,555.00		114,370.00		108,910.00	... ...	115,171.00

Cement and Broken Stone.—The following proposals for supplying 10,000 bbls. of cement and 10,000 cu. yds. of stone for the forts at Sandy Hook, N. J., and Fort Lafayette, N. Y., were opened July 26, by Lieut.-Col. G. L. GILLESPIE, U. S. Engineer Office, New York City. Cement: Lawrence Cement Co., $1.02 per bbl.; New York Cement Co., $1.03; F. O. Norton, $1.10; Calvin Tomkins, $1.12 for Fort Lafayette, $1.15 for Sandy Hook.—Broken stone: Brown & Fleming, $1.68 for limestone, $1.78 for granite; John J. Donovan, $1.97 for granite; F. H. Smith, $1.79; John A. Bouker, $1.79; Calvin Tomkins, $1.98; James L. Howell, $2.19; Ciancimino Trans. Co., $2.50 at Fort Lafayette, $2.75 at Sandy Hook.

Dikes.—The only proposal received July 25, by Lieut.-Col. G. L. GILLESPIE, U. S. Engineer Office, New York, for repairing dikes at Rondout harbor, N. Y., was from F. J. Kelly, of Brooklyn, N. Y., at the following prices: white oak piles, 27 cts. per lin. ft. of pile driven, measured after being sawed off; pine or spruce piles, 12 cts.; square timber, $40 per 1,000 ft. B. M. in place; tie rods, its plant. J. D. COOK, of Toledo, O., is consulting engineer. Furnishing and setting regulators: J. C. Giboney, Indianapolis: $43 for 3-in. H. P. and L. P., $55.50 for 4-in., $92.50 for 6-in., $137.75 for 8-in.; total, $500.75. The other bidders were J. D. McElvain, Indianapolis; Oil Well Supply Co., Lima, O.; Knickerbocker Gas Co., Philadelphia; Galvin Valve & Hydrant Co., Detroit, Mich. Pipe and specials: J. C. Giboney, Indianapolis: 9.97 cts. per ft. for 2 in. wrought iron pipe, 19.9 cts. for 3-in., 28½ cts. for 4-in., 55⅞ cts. for 6-in., 90 cts. for 8 in., 82½ cts. for 8-in. light, 67 cts. for 8-in. spiral weld. The other bidders were R. D. Wood, Philadelphia; R. Ryan, Greenville, Ind., J. D. McElvain, Indianapolis; Oil Well Supply Co., Lima; O.; Morris Tasker & Co., Philadelphia; Shickle, Harrison & Howard, St. Louis; Chester Pipe & Tube Co., Philadelphia; Spiral Weld Tube Co., New York; Addyston Pipe & Steel Co., Cincinnati; Dennis Long & Co., Louisville, Ky. The quantities are 9,430 ft. of 3-in., 27,610 ft. of 4-in., 90,880 ft. of 6-in., 5,980 ft. of 8-in.—Pipe laying: J. C. Giboney: 8.75 cts. for 2 and 3-in. wrought iron, 9 cts. for 4-in., 9.35 cts. for 6-in., 10¼ cts. for 8 in.; 10¾ cts. for 3-in.; cast iron, 12½ cts. for 4-in., 14.35 cts. for 6-in., 17½ for 8-in.; total, $12,909.30 for wrought iron, $5,754.25 for cast iron. The other bidders were John Maxwell, Kansas City; R. Ryan, Greenville, Ind.; W. T. McMahon, Bluffton; Carpenter & Bradbury, Richmond, Ind.; Craig & Hedgecock, Indianapolis; James Crosbie.—Valves and boxes: Galvin Brass & Iron Works, Detroit, Mich., $851.76 for valves, $265.50 for boxes; there will be 2-in. gate screw valves, 26 of 3-in diameter, 68 of 4-in., 16 of 6-in., 1 of 8-in.; also 3-in. extra, 5 of 4-in., 3 of 6 in., 1 of 8-in.; 118 boxes. The other bidders were R. D. Wood & Co., Philadelphia (Eddy); R. Ryan, Greenville, Ind.; J. C. Giboney & Co., Indianapolis (Jaricki valve); J. D. McElvain, Indianapolis (Jaricki); Oil Well Supply Co., Lima, O. (Eaton gate valve); Ludlow Valve Co., Troy, N. Y.; Chapman Valve Co., Indian Orchard, Mass.; Galvin Valve & Hydrant Works, Detroit, Mich.; Bingham & Taylor, Buffalo, N. Y.

contract was awarded to the Brandywine Granite Co. Lumber: Libbey, Bittinger & Miller, Washington, $1,318.90; T. W. Smith, Washington, $1,340; R. H. Willett, Washington, $1,349; R. J. McLean, Washington, $1,359; Church & Stephenson, $1,863. The contract was awarded to Libbey, Bittinger & Miller.

Elevators.—The contract for building 9 elevators of 30,000 bushels capacity, for the Martin Elevator Co., of Winnipeg, Man., along the line of the Northern Pacific & Manitoba Ry., has been let to Barnet & Record, of Minneapolis, Minn.

PROPOSALS OPEN.

Street Work.—Belgian block paving and bluestone curbing. J. P. ADAMS, Commissioner of City Works, Brooklyn, N. Y. August 7.

About 15,000 lin. ft. of curbing, 2,000 lin. ft. of 14-in. crosswalk stone, 7,000 sq. yds. of granite blocks. JOHN A. COLEMAN, Street Commissioner, Providence, R. I. August 7.

Regulating, grading and trap block paving. THE PARKS COMMISSIONERS, 49-51 Chambers St., New York, N. Y. August 8.

Improving Land View Ave. Engineer, M. D. BURK, Pike's Building, Cincinnati. HORACE HEARN, Village Clerk, Westwood, O. August 16.

Improving Central Ave. Engineer, D. S. HOSBROOK, 5 W. 4th St., Cincinnati. JAMES GIFFIN, Village Clerk, Madisonville, O. August 17.

Grading, cindering and rolling with steam roller about 2½ miles of Lake St. F. C. MOORE, Village Clerk, Ashtabula, O. August 17.

Excavation, granite curbing, grading, gutters, culverts, drains and retaining walls, on a large number of streets. THOS. G. SMITH, President, Board of Public Affairs, Cincinnati, O. August 17, 22, 23, 24.

Sewers.—In uptown streets. THE COMMISSIONER OF PUBLIC WORKS, 31 Chambers St., New York, N. Y. August 7.

Uptown. THE PARKS COMMISSIONERS, 49-51 Chambers St., New York, N. Y. August 8.

Furnishing and laying several thousand feet of 6 to 24-in. vitrified ironstone sewer pipe, with manholes, flushtanks, and lampholes. W. B. DENNETT, City Clerk, Fresno, Cal. August 12.

Trunk sewers in Apple St. and Lick Run. THOS. J SMITH, President, Board of Public Affairs, Cincinnati, O. August 17 and 26.

Buildings.—Iron work, plastering, glazing, steamheating, etc., for the Metropolitan Museum of Art. THE PARKS COMMISSIONERS, 49-51 Chambers street, New York, N. Y. August 8.

School building at Wyoming, O. SAMUEL HANNAFORD, Architect, Bradford Block, Cincinnati, O. August 10.

Plans and estimates for court-house and jail, to cost from $35,000 to $60,000. FRED. H. LYONS, County Auditor, Snohomish, W. T. August 15.

Cotton mills and machinery for same. A. WEISS, President, Galveston Cotton Mills, Galveston, Tex. August 15.

Boiler room and pump house at Long View Insane Asylum. F. RAINE, County Auditor, Cincinnati, O. August 17.

Boiler house, pump house, pump, 2 boilers, etc., at the asylum, Winfield, Kan., August 17. Industrial school at Beloit, Kan., August 23. Architect, GEO. P. WASHBURN, Ottawa, Kan. L. K. KIRK, President, Board of Trustees of State Charitable Institutions, Topeka, Kan. August 17, 23.

Pump house at Eden Park reservoir. Architects, SAMUEL HANNAFORD & SONS, Bradford Block. THOS. W. SMITH, President, Board of Public Affairs, Cincinnati, O. August 20.

Plans, specifications, and proposals for court-house and jail; cost not to exceed $185,000. FRED. GASCH, Chairman of the County Commissioners, Seattle, W. T. September 2.

Pumping station between Erie canal and Watervleit turnpike. H. E. SICKELS, Secretary of the Special Water Commission, Albany, N. Y. September 3.

Bridges.—New iron or white oak needle-beams in the county bridge over Grand river, at Cayuga. D. T. ROGERS, Warden, Cayuga, Ont. August 10.

Iron bridge over West Bernard creek. THE COUNTY COMMISSIONERS, Wharton, Tex. August 12.

Wrought iron bridge, with masonry substructure, on Duck creek road. Bidders to submit strain sheets. F. RAINE, County Auditor, Cincinnati, O. August 24.

Water-Works.—Supply from the mainland. R. H. LEE, Borough Clerk, Sea Isle City, N. J. August 7.

About 4,750 of 6 and 4-in. Converse lock joint pipe; Dow duplex pump with 2 cylinders 6x10 ins.; hydrants; 2 tanks of 30,000 galls. capacity each. D. T. SEARS, Town Recorder, Medford, Ore. August 15.

Under exclusive franchise for 25 years. Proposals must include conditions, rates, and specification, also bid for electric lighting W. H. MILLER, City Clerk, Stanford, Ky. August 20.

Gas Pipe.—About 1,897 tons of 4 to 12-in. cast-iron gas-pipe. ROBERT ALLSTATTER, President, Hamilton Gas Works, Hamilton, O. August 7.

Electric Light Plant.—For the Metropolitan Museum of Art. The PARKS COMMISSIONERS, 49-51 Chambers St., New York, N. Y. August 8.

Pier Work—Repairing crib bulkhead between piers 57 and 58 (old), North river. The DOCKS COMMISSIONERS, Pier A, North river, New York, N. Y. August 9.

Road.—Grading and constructing the Long Creek wagon road from 44th mile post on said road in Umatilla county and following the present location to the 75th mile post in Grant county. The work is divided into 6 sections, between the following mile posts: 44 to 49, 49 to 54, 54 to 58, 58 to 66, 66 to 71, 71 to 75. No contract for less than 2 miles. Bids to give name of section and price per mile. Plans and specifications on file. L. W. LOEHR, Superintendent, COMMISSIONERS of Long Creek Wagon Road, Pendleton, Ore. August 10.

Maps and Plats.—For the county assessors, F. RAINE, County Auditor, Cincinnati, O. August 10.

Culvert.—Semicircular arch culvert across Dusk creek road. F. RAINE, County Auditor, Cincinnati, O. August 24.

Culvert.—Under the Grand Trunk Ry. Plans and specifications on file. B. D. MCCONNELL, Superintendent of Water-Works, Montreal, Canada. August 13.

MANUFACTURING AND TECHNICAL.

Sewer Pipe.—The Summit Sewer Pipe Co., of Akron, O., has been incorporated. Capital stock, $100,000.

Pipe Works.—The Tennessee Coal, Iron & Railway Co. proposes to establish pipe works at Ensley, Ala.

A Compressed Steam Motor, on the system invented by J. THOMAS, of New York, is to be tried on the street railway at Pullman, Ill.

Rolling Mill.—Lewis Schofield, of Atlanta, Ga., is promoting a scheme to establish a rolling mill plant in that city, at a cost of about $75,000.

Wrought Iron Pipe.—The manufacturers have decided to advance the price 2½ per cent. on block and galvanized butt weld and the same on lap weld pipe. A 2½ per cent. advance was also ordered on casing, and a general advance, ranging from 1 to 15 cts. per ft., on the various sizes of line pipe. Boiler tubes are also advanced 2½ per cent.

Asphalt Works.—T. J. Garling & Co., of Macon, Ga., propose to put in a plant for the manufacture of asphalt and crushed granite paving blocks, and want to communicate with parties having the necessary kind of machinery.

Filters.—The U. S. Water Purifying Co., of New York, has been incorporated by GEORGE MINELLER, of Hoboken, N. J.; and CHAS. W. BALL, M. EDWARD DOWNEY, and J. W. BLATCHFORD. Capital stock, $100,000.

Garbage and Sewage Cremation.—The State Medical Society, of West Virginia, has requested the Board of Directors of the Weston and Spencer insane asylums to build furnaces or crematories. At Weston the sewers empty into the West Fork river, and at Spencer into Spring creek.

Castings.—J. P. Pero, of the foundry works at Ware, Mass., has a contract for supplying castings for the new addition to the Chapman Valve Co.'s works at Indian Orchard.

Roofing.—The contract for covering the extensive buildings of the Agricultural College, at Guelph, Ont., has been awarded the Metallic Roofing Co., of Toronto. The roofing selected is the No. 26] gauge Eastlake pattern, galvanized steel shingles.

Metal Ties.—The Pennsylvania Co., of Bellarie, W. Va., has finished a contract for 40,000 railway ties.

The Anniston Tie Co., of Anniston, Ala., has been organized to manufacture railway ties. Capital stock, $10,000.

Car Wheels.—The Garrett-Apperson Co. has been organized at Little Rock, Ark., by J. R. MILLER, J. A. GARRETT and R. D. APPERSON, to manufacture car wheels under the Fowler and Garrett patents. Capital stock $50,000.

Lake Steamers.—The Globe Iron Works Co., of Cleveland, O., has contracted for the construction of 4 boats for the Minnesota Iron Co., to cost $800,000; all are to be out within a year.' The company has also contracted for 2 more boats for the Lehigh Valley Transportation Co. These will cost $500,000, and with a boat already under way will make 7 steamers, or $1,300,000 worth of vessel property, which this company will build within the next 12 months.

Rock Drills.—The capacity of the large shops of the Ingersoll-Sergeant Rock Drill Company is tested to its extreme limit. They have orders at present for 13 air compressors, none of which have been shipped. Orders are also in for channeling machines, rock drills, etc. The Ingersoll-Sergeant Company has recently received orders for complete plants of machinery for the Aurora mine on the Gogebic range in the Lake Superior district and for the Santa Fé Copper Co., Santa Fé, New Mexico.

Supplies and Machinery Wanted.—A second-hand dredge, suitable for shallow water. P. O. Box D, Pensacola, Fla.

Dummy engine and 44-lb. rails. W. H. Jones & Son, Macon, Ga.

Dummy engine, standard gauge; second-hand, if in good condition. J. B. Colgrove & Co., 6 Wall St., New York City.

Steel rails, 20-lb.; splice bars, bolts, spikes, etc., for 1 mile of track. Washington Street Ry. Co., Washington, Ga.

Second-hand engine and boiler, 20 to 30 H. P. R. 9., World Office, Omaha, Neb.

Vertical engine and boiler, 2 to 3 H. P. Box 309, Atlanta, Ga.

Machine for manufacturing drain pipe. J. F. ELDRIDGE, Mountain House, Morganton, N. C.

The Wells Oil Light.—Keehan & Halpin, 13 Murray St., New York, have made arrangements to manufacture the Wells light plant in this country. The oil (petroleum, kerosene, or tar oil) is pumped into a portable steel tank and the air pressure of 25 lbs. forces the oil up to a heated burner, where it is converted into gas and ignited, issuing in a powerful flame. No plant is required to give air or steam pressure. It is especially adapted for railway and other construction work, and about 150 are in use on the works of the Manchester ship canal. It is extensively used in Europe, over 1,400 having already been sold by the English makers.

The Lehigh Valley Creosoting Co., operating the Lehigh Valley Creosoting Works at Perth Amboy, N. J., has removed its office from Perth Amboy to Jersey City, foot of Washington St., south of the Gap.

Locomotives.—The Schenectady Locomotive Works, of Schenectady, N. Y., will have the first of the 2 Strong engines completed in a few weeks. It is an eight-wheel engine, and practically a duplicate of the "A. G. Darwin," but with the addition of a half-extension smoke-box. Some of the work for the second engine is now in the machine shop. The works have an order from the Lake Shore & Michigan Southern for 3 eight-wheel passenger engines, 15 mogul freight engines, and 7 switch engines.

The New York Locomotive Works, of Rome, N. Y., have turned out 3 eight-wheel engines for the Rome, Watertown & Ogdensburg. They have an order for 5 engines for the Union Pacific, at $36,000.

The Rhode Island Locomotive Works have an order for 25 eight-wheel engines for the Union Pacific at $193,000.

The Pittsburg Locomotive Works, of Pittsburg, Pa., have an order for 25 fast passenger eight-wheel engines for the Baltimore & Ohio, at $175,000.

The Manchester Locomotive Works, of Manchester, N. H., have turned out a fourth engine for the Concord road. The weights of these engines are as follows: Weight of engine, 90,000 lbs; weight on drivers, 57,250 lbs.; weight on trucks, 32,750 lbs.; weight of tender loaded, 63,800 lbs.; weight of engine and tender loaded, 153,800 lbs.

The Kingston Locomotive Works, of Kingston, Ont., have built some engines weighing 96,000 lbs. each for the Lake St. John road.

Cars.—The Union Pacific Ry. Co. will expend $75,000 in new equipment. The Peninsular Car Co., of Detroit, Mich., will deliver 83 stock cars, either at Council Bluffs or Kansas City for $36,740. The company will also build 350 coal cars for $131,000, and 309 box cars for $144,000. The Michigan Car Co. will build 250 coal cars at $95,000, and a number of refrigerator cars, costing $40,000. The St. Charles Car Co., of St. Charles, Mo., will build 15 chair cars for $68,000. Wells & French have a contract for 11 cars at $4,000.

BRIDGES AND CANALS.

Bridge Work in Minnesota.—*Royalton.*—It is expected to begin work on the Mississippi bridge this winter. C. D. STEVENSON is Town Clerk.

Madelia.—An iron bridge of 1 span of 30 ft., with 16-ft. roadway, is to be built by the County Commissioners.

Redwood Falls.—The County Commissioners will build a bridge of 80 or 90-ft. span. W. E. BAKER is Chairman.

Sacred Heart.—A bridge is to be built across the Minnesota river. P. J. PETERSON and P. O. DASET are the Committee.

Dean.—An iron bridge 71 ft. long, 68 ft. clear span 16 ft. roadway, 1,200 lbs. is to be built by the Supervisors. Contract not let. Abutments now being built. B. A. POLSON, Town Clerk.

Watertown.—Stone approaches are to be built to the iron bridge. J. F. BOYLAN, Town Clerk.

Bridge Work in Wisconsin.—*West Salem.*—A wooden bridge with 2 spans of 64½ ft., 20-ft. roadway, is to be built. Plans and specifications at the Town Clerk's office. F. B. SMITH, Chairman.

Holmen.—Two iron bridges, one 75-ft. span and 12 or 16-ft. roadway, the other 20-ft. span and 12-ft. roadway, are to be built. Capacity, 8 tons. Stone piers and planking furnished by the town. THOMAS JOHNSON, Clerk.

Bridge Notes.—*Cornwall, N. Y.*—It is reported that the president of the Storm King Bridge Co. has secured the necessary capital in Europe for the construction of the bridge over the Hudson river.

Wilson, N. Y.—The town board will build a bridge 60 ft. long and 14 ft. wide across the creek.

Niagara Falls, N. Y.—The Niagara Falls & Clifton Suspension Bridge Co. has elected the following officers': President, C. H. SMYTHE, Clifton; Vice-President, WARREN BRYANT, Buffalo; Treasurer, J. M. BOSTWICK, Buffalo; Secretary, F. W. SMYTHE, Clifton.

Fultonville, N. Y.—The West Shore road has been asked to build 2 stone culverts to replace wooden structures.

Pittsburg, Pa.—The Short Way Bridge Co. has been incorporated to build a bridge over the Monongahela at So. 8th St. J. O. CAMPBELL, T. O'LEARY, Jr., J. W. PATTERSON, S. P. CONNOR, and ROBERT S. FRAZIER. Capital stock, $200,000. It will be a highway bridge, with a double-track street railway.—The South Side Bridge Co. has been incorporated to build a bridge over the Monongahela at So. 1st St. J. HARTLEY GIVEN, A. M. NEEPER, JOHN F. STEEL, of Pittsburg; JOSHUA RHODES, of Allegheny. Capital stock, $300,000.

Fort Monroe, Va.—The following proposals for an iron pile bridge over Mill creek were opened July 23 by Lieut.-Col. PETER C. HAINS, U. S. Engineer Office, Washington, D. C.: Groton Bridge & Mfg. Co., Groton, N. Y., $17,500; Sooysmith & Co., New York, $18,300; Edward L. Dent, Washington, D. C., $23,883,80.

Wheeling, W. Va.—The Board of Public Works has recommended the award of the contract for an iron bridge over Caldwell's run to the Wrought Iron Bridge Co., of Canton, O., at $1,600.

Knoxville, Tenn.—The Board of Public Works will build a bridge over First Creek from Florida St. to Willow St.

Augusta, Ga.—The contract for building the 7 piers for the river foot bridge, according to the City Engineer's specifications, has been awarded to T. O. Brown, at $1,546 each, or $10,822; also the abutment on the Georgia side for $525.

Houghton, Mich.—An iron approach to the bridge is to be built. It will be 410 ft. long, with a 16-ft. roadway and 8-ft. sidewalk. Cedar block paving. Plans, specifications and estimates are invited. Address, GEO. C. SHELDEN.

East St. Louis, Ill.—Contracts have been let to J. B. Divers & Co., of Iowa, for an iron bridge across Cahokia creek, and C. Knebelkamp, of Belleville, for a wooden pile bridge across the creek.

Cissna Park, Ill.—An iron bridge across Pigeon creek is to be built near here by the Highway Commissioners of Pigeon Grove township, Iroquois Co.

La Crosse, Wis.—The authorities at Washington have rejected the location and plans for the highway bridge across the Mississippi. New plans are to be prepared.

Milwaukee, Wis.—The construction of the Michigan St. bridge will be delayed, as the city has no money available, and the incoming taxes for the current year, although not collected, have already been disposed of for other purposes.

Topeka, Kan.—Mr. KINGMAN, City Engineer, has been directed to prepare plans and specifications for a steel arch bridge across the Kansas river at Kansas Ave.

Kansas City, Kan.—The pontoon bridge project is not yet decided upon. Col. S. N. STEWART, of Leaven-

worth, is the projector of the scheme. Bonds for $26,000 are to be issued; $13,000 preferred stock to be sold for cash; the remaining $13,000 to be held as secondary stock and to receive no dividend until the preferred stock had received 10 per cent. per annum above all expenses for the maintaining the bridge. The builders are to hold the secondary stock for a term of 15 years, besides having free use of Stewart's patents, and over rights on the bridge. He agrees to construct 1,500 ft. of bridge, 50 ft. of shuttle draw and all necessary appliances as per specifications, for $13,000.

Fort Riley, Kan.—The following proposals for the construction of an iron or steel bridge across the Kansas river were opened July 20, by Capt. GEO. E. POND, Asst. Q. M., U. S. A.: A. J. Tullock, Leavenworth, Kan., $13,975, $14,360, $14,600, $15,000; Geo. E. King Bridge Co., Des Moines, Ia., $14,990, $15,498 ($295 to be deducted if wood fence is used); King Iron Bridge & Mfg. Co., Cleveland, O., $15,500, $16 000; Milwaukee Bridge & Iron Works, Milwaukee, Wis., $15,883, $16,797; Kansas City Bridge & Iron Co., Kansas City, Mo., $17,984; J. H. Hoover, Kansas City, Mo., $18 000; Horace A. Keefer & Co., Kansas City, Mo., $18,242; Clinton Bridge & Iron Co., Clinton, Ia., $19,200; Shailer & Schniglau, Chicago, Ill., $20,350, $20,860, $21,290. The bridge will consist of a main span of 250 ft. c. to c. of end pins, resting on iron tubular piers; and an approach span of 80 ft. c. to c. of bearings, one end of which will rest on the iron pier under the north end of the main span, and the other on a masonry abutment. The spans will be level, but the roadway will be on a grade of 5 per cent.; the headway will be not less than 15 ft. The width of the roadway will be 18 ft. The main span will be a pin-connected truss, with parallel chords of any of the standard types, and the approach may be either pin-connected, plate or lattice girder. This span will be located over the tracks of the Union Pacific Ry. The superstructure will be of iron or steel throughout, with the exception of the roadway floor and joists, guard rails, etc. W. H. STAIR is the engineer.

Canals.—*Florida.*—The project of constructing a canal through the chain of lakes between Orlando and Lake Jesup is being discussed, and surveys will probably be made for a preliminary estimate.

Gowanus.—Dr. GRIFFIN, Health Commissioner, is President, and P. K. MCCANN Secretary of the commission appointed by Mayor Chapin, of Brooklyn, N. Y., to report on the improvement of the Gowanus canal.

New York State Canals.—The following proposals for lengthening the locks on the Erie and Oswego canals under the $900,000 appropriation made by the last Legislature were opened in the office of the Superintendent of Public Works, at Albany, N. Y., July 30.

Lock No. 65, Erie canal (Monroe County): B. P. Smith, of Rochester, $30,289.50; William Patrick, Fulton, $27,169. Awarded to the latter.

Lock No. 66, Erie canal: B. P. Smith, $28.653; William Patrick, $25,767.50. Awarded to Patrick.

Lock No. 9, Oswego canal: William Patrick, $28,155.85; W. S. Nelson, of Oswego, $24,242; Case & Jennings, of Fulton, $26,005.25. Awarded to W. S. Nelson.

Dock No. 10, Oswego canal: William Patrick, $25,357.60; W. S. Nelson, $23,885; Case & Jennings, $25,458. Awarded to W. S. Nelson

For rebuilding Lock No. 12, Black river canal: Stryker & Huntington, of Rome, $15,994; Frank A. Barrett, of Boonville, $15,509.90. Awarded to the latter.

On the four remaining locks to be lengthened, Nos. 23, 24, 25, and 26, Erie canal, Hughes & Bro., of Syracuse, were the only bidders. Their bids were held for further consideration.

ELECTRICAL.

Electric Power.—The Selectmen of Beverly, Mass., have given a hearing to the Robinson-Foster Electric Motor Co., which has applied for the right to establish a plant to furnish power to the city for manufacturing purposes. Considerable opposition was met with from the Beverly Electric Light Co. The Selectmen took the matter under advisement.

Electric Light.—*Bangor, Me.*—The city has contracted with the Jarvis Engineering Co. to put in an Armington & Sims 150 H. P. engine and 2 boilers, at the water-works, to furnish power for the city's electric light plant in case the water power should at any time be insufficient. The boilers are 6 ft. by 17 ft., with 138 tubes 3 ins. diameter; they are built at the Penobscot Boiler Works, Bangor.

Batavia, N. Y.—The Consumers' Electric Light & Power Co. is erecting poles and stringing wires.

Washington, D. C.—The District Commissioners have under consideration a proposal from the Electric Heat & Power Co. to light certain streets in that portion of the city north of K. St. to Boundary and running as far east as 1st St. with incandescent lights of 25 c. p., at $18 per annum per light, using the lamp posts now upon the streets. The company will conform to the specifications prepared by the engineer department of the district for conducting such a service, which requires that all the lines shall be placed in underground conduits and the work and service connected with the whole operation to be first-class in every respect, using the Westinghouse system of lighting with lead-covered cables manufactured by the Standard Underground Cable Co.

Charleston, W. Va.—The Charleston Electric Heat, Light & Power Co., has been incorporated by F. P. JEPSON, ALLEN BROCK, J. A. H. ADAMS, F. P. MCNELL, of Wheeling, and C. P. SNYDER, of Charleston. Capital stock, $200,000.

Cynthiana, Ky.—The city has contracted for 96 incandescent electric lights of 25 c. p., at $15 each per annum to be lighted until midnight.

Middlesborough, Ky.—The Middlesborough Water, Light & Power Co. has a contract with the city for both arc and incandescent lighting on the Thomson-Houston system.

Covington, Ga.—It is proposed to put in an electric light plant in connection with water-works.

Fostoria, O.—The Fostoria Electric Light & Power Co. has been incorporated, and will succeed the Fostoria Electric Light Co. The gas and electric light companies will be consolidated. Capital stock, $100,000.

Bay City, Mich.—The Bay County Electric Light Co. has a contract for a plant to be erected in this city. The company has adopted the Westinghouse incandescent and United States arc lights.

Cicero, Ill.—The Chicago & Cicero Water, Light & Power Co., of Morgan Park, has been incorporated by F. S. OSBORNE, M. H. BURGETT and HY. R. PEBBLES. Capital stock, $50,000.

Rochester, Minn.—The City Council has granted to GEORGE H. WEDGE an electric light franchise, not to be exclusive, to run for 25 years, and to be subject to city control if underground wiring at any time seems desirable.

Atchison, Kan.—The Electric Light Co. expects to expend $15,000 before cold weather. The proposed incandescent system will cost $16,000, and the new city street lights will cause an expenditure of $5,000.

Albany, Ore.—The Albany Electric Light & Power Co. has been incorporated by N. H. ALLEN, D. P. MASON, and GEO. E. CHAMBERLAIN. Capital stock, $30,000.

SEWERAGE AND MUNICIPAL.

Drainage.—The contract for draining the great meadow on the Passaic river, above Little Falls, has been awarded to A. B. Nelson, of New Brunswick, the lowest bidder. The work includes: (1) the reduction of the Beattie dam at Little Falls, 20 ins. below its height; (2.) The excavation of a channel on the north bank of the stream, through a section of the trap rock on which the dam was built, 16 ft. in depth, and 25 wide. This channel will extend through the dam up the lower rock reef to deep water on a grade of 1 in 10 ft.; (3.) To facilitate a free flow of water, a channel of 200 ft. in width is to be cut through the upper reef, and to a depth of 5 ft.; (4.) The bar in the bed of the river at Two Bridges is to be removed to the depth of 4 ft. and 200 ft. wide to the mouth of the Pequannock river, and then following the Passaic to a width of 100 ft. to the end of the bar; (5.) A cut-off is to be excavated at Pine Brook to pass through the plank bridge on the Morris county side of the river, which is to be 70 ft. wide and 5 ft. deep. Altogether, it covers a territory of 13,500 acres.

City of Mexico, Mexico.—Work on the tunnel and the canal for draining the valley of Mexico is going forward energetically, and it is stated that in 2½ years it will be completed. Very soon the reconstruction of the sewers of the city will be begun, so as to have the system perfected by the time the canal and tunnel are finished.

Amsterdam, N. Y.—The Sewer Commissioners have presented their report for the year ending in June, 1889. The separate system was adopted, being recommended by Mr. RUDOLPH HERING and Col. GEO. E. WARING. The engineer of construction was Mr. WM. B. LANDRETH, of Schenectady, and P. Shannon was the contractor. The history and present condition of the system are given. The reports of Col. WARING and Mr. LANDRETH are included, together with tables of the prices of bids for the work.

Norwich, Conn.—The Finance Committee has presented its report to the Common Council on a system of sewers for the central drainage district. It is accompanied by a full report from Mr. CHAS. E. CHANDLER, the engineer appointed to prepare surveys and plans for a sewerage system, and a letter from Mr. RUDOLPH HERING, to whom Mr. CHANDLER submitted his report.

Sewers.—*Albany, N. Y.*—An ordinance has been passed for the construction of a 12 and 15-in. pipe sewer on Mohawk St., with manholes, basins, etc.

Buffalo, N. Y.—Resolutions have been adopted by the City Council, providing for the construction of a brick and tile sewer in Main St., a tile sewer in Beck St., a 10-in. tile sewer in Highland Ave., and sewers in Auburn Ave., and Chippewa St. The engineer has been directed to advertise for proposals.

Syracuse, N. Y.—Contracts have been awarded to Patrick Ready, at $2,422.50, and $2,424.60 for 24-in. tile sewers in Grape St., and Mulberry St. The 24-in sewer in Mulberry St, is to be extended, and an 18-in. tile sewer built in Orange St.

Pittsburg, Pa.—The prices for sewer on Atwood St were 78 cts. and $1.65 per ft. for 9-in. and 15-in. pipe; $40 for drops, and $40 for manholes. For the sewer on Wright's alley, $1.24 per ft. for 15-in. pipe, $30 for manholes.

Savannah, Ga.—Mr. RUDOLPH HERING, C. E., has investigated the sewerage project, and recommends the discharge into the Savannah river, as far down as possible.

Denver, Col.—The Board of Public Works will build a sewer on 31st St. and other streets. It will be of 8, 10, 12, and 15-in. pipe, with manholes and branches. Estimated cost, $107,834.80.

East Portland, Ore.—An ordinance has been introduced to appoint a committee to investigate the sewerage question and submit plans and estimates.

Houston, Tex.—The city has passed a resolution providing for the construction of sewers and drains in District No. 1. For particulars address the Board of Works.

San Diego, Cal.—A report on the sewerage system is being prepared by JAS. D. SCHUYLER.

Anniston, Ala.—The contract for pipe has been let to the Globe Sewer Pipe Co., of Pittsburg, Pa., at $25,288.73; and the contract for construction to McDonald & Campbell at $17,987.74.

Newark, O.—The contract for 500 ft. of sewer on Locust St. has been let to S. J. White, at $1,400.

Cincinnati, O.—The Board of Public Affairs has had plans and specifications prepared for the construction of sewers and drains in part of Division No. 16.

East St. Louis, Ill.—The contract for the sewer on Broadway has been let to W. H. Hill & Bro., of East St. Louis.

Duluth, Minn.—The Board of Works has engaged Mr. RUDOLPH HERING, of New York, and Mr. ANDREW ROSEWATER, of Omaha, Neb., to lay out an extension of the sewer system.

Hannibal, Mo.—A system of sewerage is to be built. The cost is estimated at $40,000 for the 7 main sewers, and $30,000 for local sewers.

Street Work.—*Westchester, N. Y.*—The town will issue bonds for $9,000 for highway improvements.

Syracuse, N. Y.—Contracts have been awarded to James McLaughlin, at $2,371, for macadamizing John St.; J. W. Bustin, at $362, for grading Davis St.; Adam Mosher, 72 cts. per yd. for gravel. Resolutions have been adopted for further work.

Bellevue, Pa.—Resolutions have been adopted for street extensions.

Louisville, Ky.—A considerable amount of street work is to be done. It includes asphalt and granite paving, flagstone gutters, etc. CHARLES D. JACOB, Mayor.

Columbus, O.—The city engineer has prepared estimates for stone block, brick, Hayden or Hallwood block, and asphalt paving on several streets. Also curbing, grading, graveling, etc.

Peoria, Ill.—An ordinance has been prepared by the the engineer, providing for brick paving on Knoxville Ave.; the brick will be 3 x 5 x 10 ins.

East St. Louis, Ill.—The contract for filling and granite paving on Broadway has been awarded to Allen & Vieths, of St. Louis; and for curbing and sidewalks to Neimes & Reiman, of East St. Louis.

Duluth, Minn.—The Board of Public Works has awarded a contract for grading and paving on 1st Ave. to Zimmerman & Moore, at $22,454.50.

Topeka, Kan.—Contracts have been awarded to James Ramsey for brick paving on Van Buren St., and to Kepley & Ament for Colorado sandstone paving on 4th St.

Omaha, Neb.—Paving district No. 248 has been created, and the property owners will decide shortly upon the material to be used.

Seattle, W. T.—The city is making assessments for a number of street improvements. C. W. FERRIS is City Clerk.

Houston, Tex.—The County Commissioners of Harris County, have been petitioned to improve the County roads, and to open a road to Bray's bayou.

WATER-WORKS.

NEW ENGLAND.

Ellsworth, Me.—The contract with the company calls for 50 hydrants at $1,800 per year.

Barton, Vt.—GEO. H. BLAKE has sent us the following:

The town has issued $16,000 of bonds and will let contracts Aug. 1 for works to be completed Oct. 15. The estimated cost is $18,000. Water will be taken from a brook 6,000 ft. from and 250 to 350 ft. above the town. It will be used for fire and domestic purposes. The commissioners are T. W. DREW, Chairman; GEO. H. BLAKE and E. F. DUTTON. Engineer, JOEL FOSTER, Montpelier. Population, 1,000.

Avon, Mass.—Action will be taken upon the water report July 31.

Boston, Mass.—Bids will be received Aug. 5 for building a dam at Lake Cochituate. [Quantities were given in our last issue on p. xxxiii.—ED.]

Gloucester, Mass.—The water company will probably extend its mains to Magnolia as soon as their contract is ratified and the city grants them the right of way. They will require 25 hydrants.

Reading, Mass.—It is reported that works will be built. Address the City Clerk.

Springfield, Mass.—An appropriation of $1,700 has been made for a water tower for the Indian Orchard schoolhouse.

Newport, R. I.—Surveys for a new reservoir have recently been made. If built, it will be located in Lawton's valley, Portsmouth. Address GEO. H. NORMAN.

Coventry and Warwick, R. I.—The following is from HERBERT B. BARTON, Secretary and Engineer, Centreville, R. I.:

The Warwick & Coventry Water Co. has closed a contract with the Warwick Fire District for 53 hydrants at $30 each for 20 years; also one with the Coventry Fire District for 50 hydrants at $30 each for 10 years. They will issue bonds and build a gravity system, taking the supply from a lake. The works are to be completed by January, 1891. President, JOHN ARNOLD, Phenix, R. I.

Windsor Locks, Conn.—The company will place 26 hydrants. Work on the new dam and cleaning out the old pond will also begin soon.

Thompsonville, Conn.—The 35-ft. stand-pipe is to receive an addition of 15 ft.

Warehouse Point, Conn.—The company proposes to build a 150,000-gall. stand-pipe on Keohler's hill. Work on the extension from Enfield has been begun.

Bristol, Conn.—The Bristol Water Co. is now building a dam across Poland river to form a storage reservoir. It will have an area of 40 acres and a depth of 20 to 30 ft.

MIDDLE.

Brooklyn, N. Y.—The Long Island Water Supply Co. will probably erect 25 drinking fountains in the Twenty-sixth ward.

Corning, N. Y.—The 3,000,000-gall. reservoir has just been refilled.

Newburgh, N. Y.—The $40,000 filtering-plant project has been defeated by a vote of 376.

Waterford, N. Y.—The company will furnish power for operating the new lift-bridge.

Silver Springs, N. Y.—Work has been begun on the new works.

Brockport, N. Y.—Bassett Bros., Buffalo, N. Y., will build the works. The contract calls for 70 hydrants.

Franklin, N. Y.—Bids for complete works will be received on Aug. 5. DAVID A. BETTS, President Board of Water Commissioners.

Long Island City.—The water supply is inadequate. Additional wells will probably be sunk, and an expert employed to report upon a plan for a better system.

Buffalo, N. Y.—Coffin & Stanton, New York, have purchased $100,000 of 7 per cent., 20-year water bonds, at $56,171 premium. The money will be used in building the new reservoir on the Dodge farm.

St. Johnland, N. Y.—Bids for improving the distributing reservoir on the Kings Co. farm will be received on Aug. 6. Address the Board of Supervisors of Kings Co., Room 13, County Court House, Brooklyn.

Gloversville, N. Y.—J. L. GETTMAN, New York City, has sold $55,000 of 3 per cent. bonds at par. The works will now be extended and improved.

Sandy Hill, N. Y.—The Spring Brook Water Co. has obtained a franchise from Ft. Edward authorities to lay mains to the Agricultural Society's fair grounds.

Jamestown, N. Y.—Reports state that the American Water-Works & Guarantee Co., Ltd., Pittsburg, Pa., W. S. KUHN, General Manager, has purchased these works.

Hamburg, N. Y.—H. S. SPENCER, Secretary and Treasurer, has sent us the following:

Contracts will be let in 30 days for works to be completed in October. Water will be pumped from wells to a stand-pipe. Estimated cost, $5,000 to $8,000. They will be owned by the Hamburg Water and Electric Light Co. Capital stock, $12,000. President, T. L. BUNTING. Population about 1,800.

Albany, N. Y.—Tests are now being made by running one pump 8 hours daily; 6,000,000 galls. are thus obtained. When the 3 pumps are again tested the contractors expect to raise 17,000,000 galls. daily, and anticipate no further trouble, thereafter, in furnishing regularly the guaranteed supply of 15,000,000 galls.

Coney Island, N. Y.—Twenty-four wells have been sunk at King's Highway, Gravesend, a 1,000,000-gall. receiver erected and 8,000 ft. of pipe laid, connecting them with the Coney Island main. It is reported that water will be furnished free to all who will pay for making connections with the mains. The contractor was FRANK P. GALLAGHER.

Baldwinsville, N. Y.—The $20,000 bond of the Board of Water Commissioners has been filed. Bids will be opened on Aug. 2 for complete works. C. B. BALDWIN is Secretary.

South Orange, N. J.—The Water Committee recommend issuing $5,000 of 4½ per cent. 5 year bonds, with which to purchase pipe and hydrants; also entering into a contract with the city of Orange for a water supply; the same have offered to supply water at very reasonable rates.

Newark, N. J.—A vote of 22 to 7 in favor of contracting with the Lehigh Valley R. R. Co. for a water supply has been taken.

Tuxedo Park, N. J.—The contract for building dam No. 5 has been awarded by SAMUEL W. MCELROY, Engineer in charge, to JAS. RAYMOND at $31,795. It is to be completed by Nov. 1.

New Brighton, Pa.—A filtering plant will be added by the Hyatt Pure Water Co., of New York City.

Dravosburg, Duquesne and Homestead, Pa.—Application for a charter for the Mifflin Township Water Co. has been made by prominent capitalists at McKeesport. They propose erecting a large reservoir on the heights, near Duquesne, to supply these and other towns along the Monongahela river with water.

Wall and Wilmerding.—Proposals were received Aug. 1 by the East Pittsburg (Pa.) Improvement Co. for erecting a brick engine and boiler house, with chimney, building a brick receiving well and masonry pump-pit, and laying 500 ft. of influent pipe for the Turtle Creek Valley Water Co., near Port Perry.

Scranton, Pa.—A vote on the question of bonding the city for $800,000, with which to build and own works, will be taken July 30. The proposed source of supply is the upper Lackawanna river, in Susquehanna county.

Phillipsburg, Pa.—WM. E. IRWIN, Secretary, informs us that 2 miles of mains will be laid, also that a 1,500,000-gall. Holly-Gaskill pump has been added.

Philadelphia, Pa.—Engineer RUSSELL THAYER, representing a syndicate, has sent a proposition to Mayor E. H. FITLER, to furnish the city with water at 10 per cent. below the present cost. His plan is to convey water from the upper Delaware to the city through an aqueduct. The estimated cost of the work is $20,000,000. [See comment in another column.—ED.]

SOUTH ATLANTIC AND SOUTH CENTRAL.

Salisbury, N. C.—A filtering plant is to be added.

La Grange, Ga.—The following information has been received from E. D. PITMAN:

Works are wanted to furnish 100,000 galls. per day. The city has no debt and has legal authority to raise the money.

Tallahassee, Fla.—The American Pipe Co., has the contract to build works. They will be commenced in October and completed by July 1, 1890.

Decatur, Ala. — The Decatur Water Co. will lay 10 miles of mains and increase their daily pumping capacity to 6,000,000 galls.

Spring Garden, Ala. — All machinery and supplies have been received and the works are nearly completed. The officers are: J. W. TUCKER, President; W. M. GRAHAM, Secretary; W. T. CLARK, Treasurer.

Meridian, Miss.—Complaints are being made of the quality of the water.

Baton Rouge and West Baton Rouge, La.—The Cook Well Co. St. Louis, Mo. has the contract for sinking tubular wells.

West Knoxville, Tenn.—The City Council wants propositions for furnishing the city with a complete water supply. Address the Mayor.

Stanford, Ky.—Bids for works complete will be received until Aug. 20. A 25 years' exclusive franchise will be granted. Address W. H. MILLER, City Clerk.

Bowling Green, Ky.—The Louisville & Nashville R. R. Co. will build a reservoir and erect a pump at an estimated cost of $10,000.

Mayfield, Ky.—A. B. CARLIN, City Clerk, informs us that works are soon to be built by the Mayfield Water & Light Co. Water will be pumped to a stand-pipe. Population, 2,500. Address, B. A. NEALE.

Georgetown, Ky.—Works are being built by the Georgetown Water-Works Co. The supply is taken from springs and pumped direct to mains. Address, JOHN NICHOLS.

Middleborough, Ky.—JOHN H. MEAD, Lexington, Ky., sends us the following:

The Middleborough Water, Light & Power Co. will organize Aug. 20. It has just closed a contract with the Middleborough Tower Co. for a gravity system of works.

NORTH CENTRAL.

Columbus, O.—Superintendent A. H. MCALPINE is in favor of appointing a committee to thoroughly investigate the question of water supply for fire protection, and states that the city has outgrown the present system.

Washington C. H., O.—Pipe for the new works is being laid. The stand-pipe will be 134 ft. high, by 20 ft. diameter, and have a capacity of 300,000 galls. The receiving reservoir will be 425 ft. wide, 600 ft. long and 3 to 13 ft. deep, with a capacity of 6,000,000 galls.; it is now proposed to make 2 basins. There will be 2 boilers and 2 engines of 2,500,000 galls. daily capacity each. The 16 miles of pipe was furnished by the Addyston Pipe & Steel Co., of Cincinnati, O.; the gates and hydrants by the Chapman Valve Co., of Boston, Mass. Mr. DAVENPORT is superintending the construction of the work for the Washington Water Co.

Bowling Green, O.—IRA C. TABOR informs us that the town is very much in need of works.

Sidney, O.—New works are to be built. Plans were furnished by GEO. HORNUNG, Cincinnati, O.

Marion, O.—The company has awarded its pipe contract to the Lake Shore Foundry, Cleveland, O.

Miamisburg, O.—It is reported that the town voted to issue bonds July 19, and that nothing further has been done.

Terre Haute, Ind.—N. W. Harris & Co., Boston, Mass., are now offering $100,000 of 6 per cent. water bonds for sale.

Hudson, Mich.—Water-works are wanted. Address the Town Clerk.

Ypsilanti, Mich.—The town now has fire protection. The works will be completed soon.

Marshall, Mich.—Sufficient water to supply the town has been found at a depth of 17 ft. The well is 30 ft. in diameter. It will be sunk to a depth of 30 ft.

Grand Rapids, Mich.—The Hydraulic Co. informs us that it is now laying about 5 miles of pipe and placing 21 hydrants.

Frankfort, Mich.—We have received the following from CHARLES BUNMEISTER:

We have no works. A wide-awake man could easily get a charter to build them. Address the Business Men's Committee.

Evanston, Ill.—The First National Bank of Chicago has purchased $25,000 of water and sewer bonds. Improvements will be made.

Woodlawn Park, Ill.—Water and sewer pipes have been laid throughout the town.

Chicago, Ill.—Filters will probably be added. Engineer COLE has inspected several plants for the city.

Winnetka, Ill.—The survey of the village for the proposed water system has been completed by Mr. GREELEY.

Pekin, Ill.—Mains are being laid to supply Hodges & Co.'s harvesting machinery works with water.

Pinckneyville, Ill.—A petition to the City Council, protesting against the city pledging more than $6,000 for works is being circulated.

Washington Heights, Ill.—C. A. FRANK informs us that the city will soon have works.

Peoria, Ill.—The new company has sunk 18 wells and expect to furnish the new supply early in August.

Appleton, Wis.—Work has begun on the new 2,500,000-gall. reservoir.

Depere, Wis.—A syndicate is to purchase the works.

Washburn, Wis.—Four miles of mains will be laid, and a 1,000,000-gall. reservoir constructed. The supply will be taken from Lake Superior. W. G. MAXCY is President of the Water-Works Co., and Moffett, Hodgkins & Clarke, Watertown, N. Y., are the contractors.

Antigo, Wis.—J. F. DOYLE, Mayor, sends us the following:

The question of building works is now being agitated. If a reliable company will erect a system of work for a yearly rental of $5,500 for 50 or 60 hydrants we are ready to act at once. We want to have works built this summer.

NORTHWESTERN.

Kingsley, Ia.—J. A. INGALLS, Recorder, informs us that they can raise about $4,200 by bonding, but that the works complete will cost about $5,000. He thinks, therefore, the matter will be dropped. Population, 1,000.

Missouri Valley, Ia.—J. S. WATTLES, City Engineer, informs us that all bids received for building works exceeded the appropriation and were therefore rejected. The plans will probably be changed to reduce the cost to the amount available and new proposals invited.

Grand Junction, Ia.—Works are projected.

North Des Moines, Ia.—Works will be built soon. The vote on July 20, on the question of the town establishing a separate system of works, resulted in 215 votes being cast for and 15 against the project.

Sioux City, Ia.—An independent main is to be laid between the pumping-station and the reservoir. The new pumping-station has been accepted from Contractor WHITTEN.

Albert Lea, Minn.—At a meeting of the council, July 23, it was decided to invite bids for works to be constructed this season. A 25 years' franchise will be given and the town will pay a fair hydrant rental. R. M. TODD is President of the Board of Public Works.

Duluth, Minn.—A 7,000,000-galls. reservoir is to be constructed east of Chester creek, east end. Work on the site is now in progress. It is to be completed before winter. A public well is projected.

Owatonna, Minn.—C. E. LUCE has sent us the following:

The city will be bonded to build works. Estimated cost, $3,000. Water will be pumped from a well to a stand-pipe. No engineer has been employed and no contracts made. Work is to be begun as soon as possible. Address C. W. HADLEY, Chairman of the Water Board.

Girard, Kan.—The following information has been sent to us by JAS. S. JAMES, Superintendent:

Works are about to be built. There will be a pumping capacity of 2,000,000 galls., 6½ miles of mains and 32 hydrants. [A small system was built in 1882.—ED. ENG. NEWS.]

Winfield, Kan.—Sealed proposals will be received until Aug. 17, for erecting a boiler-house, laundry and pump-house, putting in a system of water-supply, as well as overhauling the present system of steam heating and water supply, at the Asylum for Imbecile Youths. L. K. KIRK, President.

Holdrege, Neb.—The city failing to comply with the terms of the contract, A. H. FITCH, Omaha, builder of the works, has shut down the pump, thereby depriving the city of both water and light.

Tekamah, Neb.—The town will issue $15,000 of bonds and will build works. A majority vote of 157 was taken July 19.

Cedar, Neb.—A canal is to be built from the Platte river, with a fall of 70 ft. to the mile, to furnish water for all purposes. The estimated cost is $12,000. Address the Town Clerk.

Huron, Dak.—Artesian wells are again projected.

Aberdeen, Dak.—Bids for about 10,000 lin. ft. of pipe, together with the necessary hydrants and valves, will be

received on Aug. 8. Prices are desired on both kalamein and cast-iron pipe. Specifications will be furnished on payment of $4.00. F. HOWE, City Auditor.

Highmore, S. Dak.—Bids are wanted for sinking an artesian well. F. M. BARNES, Town Clerk.

Scotland, S. Dak.—J. V. TIEBEL, Secretary, informs us that bids for works complete will be received on Aug. 13. Water will be pumped from a spring to a tank. The estimated cost is $11,000; $10,000 of 6 per cent bonds have been issued. Engineer, CHAS. F. LOWETH, St. Paul, Minn. [Quantities given in another column.—ED.]

Tyndall, Dak.—Bids for building works were received July 31. A 4½-in. artesian well, 735 ft. deep is to furnish the supply. A stand-pipe will be used. The town has issued $7,000 of bonds. Work will begin Aug. 15, and be completed Oct. 15. Population, 1,000. City Auditor, HENRY B. PHENIX.

Evanston, Wyo.—The town is to issue $20,000 of bonds for works. Address, E. L. HALLOE, Jr.

Great Falls, Mon.—The following information was given to us by J. B. LESLIE:

A Holly system of works, costing from $80,000 to $100,000, has been constructed by the Great Falls Water Co. President, E. G. MOODY; Secretary, A. E. DICKINSON; Engineer, JOHN A. COLE, Chicago, Ill.; Contractors, Swanson & Coombs, Great Falls. The supply is taken from the Missouri river. Population, 2,500.

SOUTHWESTERN.

Fulton, Mo.—Contractor DEWEY has nearly completed the works. Water will be pumped from an artesian well, 900 ft. deep. Total cost, $8,000.

Washington, Mo.—Six hydrants have just been placed. The contract for erecting 3 drinking fountains has been awarded to HELMUTH MAYN.

Camden, Ark.—It is now reported that the water company will lay 3 or 4 miles of mains, erect a stand-pipe 15 ft. in diameter by 75 ft. high, and add a 1,000,000-gall. pump.

Floresville, Tex.—Bids are wanted for boring one or more artesian wells. Address the Floresville Water-Works Co. President, J. C. KROGER; Secretary, W. O. MURRAY.

Taylor, Tex.—The Artesian Well Co. has been organized. Capital stock, $5,000. They will drill for water at once.

Eagle Pass, Tex.—Three miles of large mains, a 2,000,000-gall. reservoir and a 1,000,000-gall. pump, with boiler, will be added. Address, F. S. HARTZ, President.

Hempstead, Tex.—The city needs works and expects to have them soon.

Bryan, Tex.—A. B. CARR has sent us the following:

The contract for works on the franchise plan will be let Aug. 6. Water will be pumped from wells, 180 to 220 ft. deep, to a stand-pipe. M. PARKER is Chairman Water-Works Board. Address, T. N. CAREY. Population, 4,000.

Bastrop, Tex.—The Bastrop Improvement & Investment Co. will build a gravity system of works, taking their supply from artesian wells. Work will not be commenced for some time. President, J. C. BUCHANAN; Secretary, D. P. JOHNSON. Estimated cost, $20,000 to 25,000. Population, 3,500.

Gilman, Colo.—F. A. MORSE informs us that works to cost $5,000 will be built by the Gilman Water Co. The supply to be pumped from the river. President, N. EDWARDS; Secretary, JOHN CLAYTON. Population, 1,500.

PACIFIC.

Bellingham Bay, Wash.—We have received the following from W. M. LEACH:

Works are to be built by the Bellingham Bay Water Co. President, EDWARD ELDRIDGE; Secretary, J. L. ROMER. Estimated cost, $160,000. Contractors, B. B. & B. C. R. R. Co. The supply will be taken from Whatcom lake, 3½ miles from, and 317 ft. above the town. Works are to be completed in December. Population, 2,500.

Chehalis, Wash.—The Chehalis Flume & Aqueduct Co. has been incorporated to furnish water for fire protection. Capital stock, $20,000.

Aberdeen, Wash.—The organization of a water company is now an assured fact.

Puyallup, Wash.—New mains are to be laid. Address the Puyallup Water & Light Co.

La Grande, Ore.—The Holly system will probably be established by capitalists from Eau Claire, Wis. They would also furnish electric light by the same plant.

East Portland, Ore.—A petition has been received from E. C. LAKIN, asking the privilege of laying water pipes from the East Portland Water Co. mains, now laid throughout the streets of Albina, into all the houses desiring said water, and also through the streets of the new addition to Albina.

Medford, Ore.—Works are to be built. Town Recorder, D. T. SEARS. [See notice of proposals to be received until Aug. 15 in another column.—ED.]

Folsom City, Cal.—The following information is from G. W. CAPLES:

The Natoma Water & Mining Co. will take water from a reservoir, and supply the principal business streets with water. Work is to be completed by December. A stand-pipe will be used. Estimated cost, $1,000. Address, CHAS. SCHUSSLER, the Engineer. Population about 1,000.

Felton, Cal.—J. I. SCOTT informs us that a small system of works has been constructed by the Felton Water Co.

Reno, Nev.—C. C. DOWNING has bought a third interest in the works for $25,000.

Winnemucca, Nev.—A good flow of water has been struck at a depth of 33 ft.

Nampa, Idaho.—Artesian wells are being sunk by A. M. KURTZ.

Ogden, Utah.—A contract has been made with the Bear River Canal Co. to furnish a water supply. Address JOHN R. BOTHWELL.

CANADA.

Montreal, P. Q.—The Canada Water Pipe Co. is behind on its orders and has delivered only 60 of the 240 tons of pipe ordered by the city. A special appropriation has been made, and 100 tons of 6-in. pipe will be ordered elsewhere for immediate delivery.

Toronto, Ont.—C. A. MATTHEWS, Secretary of Water-Works Department, informs us that the following contracts have been awarded: Furnishing 6,000 ft. of 60-in. steel plate pipe to JOHN ABELL, Toronto, at $9.89 per ft.; 4,600 ft. 48-in. steel plate pipe to the Peterborough (Ont.) Bridge Co., at $7.06 per ft. For laying divisions 1 and 2 of the conduit, 60-in. and 48-in. respectively, to F. B. MCNAMEE, Montreal, P. Q., at $29,642.38.

Deloraine, Man.—A. P. STUART has sent us the following:

An artesian well to furnish a water supply is now down 1,060 ft. It will probably be sunk to a depth of 1,500 ft.

Victoria, B. C.—A vote was to be taken, July 23, on the question of issuing $70,000 of bonds.

[NOTE. The following information was received too late for insertion in regular order:]

NEW ENGLAND.

Salem, Mass.—An order has been adopted authorizing the water board to employ a competent engineer to ascertain if the present main is of sufficient capacity to furnish water for a stand-pipe on Gallow's hill.

MIDDLE.

Jersey City, N. J.—The water committee have submitted the form of a contract with the Bartlett syndicate, which they recommend to the public. It requires the production of a water supply from heads above latitude 41°. The city is to pay into the hands of the syndicate the amount of the water receipts less the amount needed to meet the tax on the bonded debt and less 15 per cent. for the collection of the water revenues. It is also to have the privilege of purchasing the plant within 25 years at the rate of $1,000,000 for every 10,000,000 galls. of supply, the improvements and additions to be put in at cost, with a graded allowance for depreciation. The contract also exacts 10 per cent. of the gross amount for the use of the city's plant for the supply of the other places.

Mr. Bartlett states that his syndicate cannot afford to sell the city a 50,000,000-gall. water plant for $5,000,000; that 15 per cent. for the collection of water revenues is too high, and that the suggestion that 10 per cent. of the revenue be paid to Jersey City for the right of way to some other city is out of the question. The general plan of the contract would, however, be acceptable to the company if proposed by the city authorities.

East Orange, N. J.—Additional mains are being laid.

Sea Isle City, Pa.—Bids for building works to be operated on the franchise plan will be received until Aug. 7. Address R. H. LEE, Clerk Committee on Water-Works.

South Atlantic and South Central.

Biloxi, Miss.—Works will be built at once. A good supply of water has been obtained from the Howard well at a depth of 425 ft. The Biloxi Artesian Water-Works Co. has been organized. Capital stock, $8,000.

North Central.

London, O.—An ordinance has been passed awarding the contract to build works to JOHN P. MARTIN, Xenia, O. It will be ratified by a public vote Aug. 28.

Wyandotte, Mich.—Bids for building works will be received until Aug. 8. Secretary Water-Works Committee, J. S. MCGLAUGHLIN. Engineer, J. D. COOK, Toledo, O.

East St. Louis, Ill.—It has been voted to increase the capital stock from $250,000 to $750,000. The following officers have been elected: President, F. M. HORNER; Secretary, S. M. HIGHLAND; Directors, HARVEY HILL and JOHN MCINTIRE.

Collinsville, Ill.—Works are to be built.

Hudson, Wis.—Bids were received July 29 for constructing a new masonry reservoir after plans by W. W. CURTIS, St. Paul, Minn. Secretary, C. P. COON.

Milwaukee, Wis.—A new pumping engine and additional boilers are to be purchased. Some additional mains will also be laid. The Committee on Finance has approved the ordinance authorizing the issue of $100,000 of water-works construction bonds. Address City Engineer GEO. H. BENZENBERG.

NORTHWEST.

Marshalltown, Ia.—The works are to be improved and extended.

South Omaha, Neb.—Additional mains will probably be laid soon. The city now pays a rental of $60 yearly for each hydrant.

Nebraska City, Neb.—The old company has been reorganized and will hereafter be known as the Nebraska City Water & Light Co. Its capital stock is $375,000. General dissatisfaction is expressed with the quality of the present supply.

PACIFIC.

Nevada City, Cal.—The recent water bonds election proves to have been irregular. Another vote will soon be taken.

Santa Cruz, Cal.—Engineer SCHUSSLER reports that he can build permanent works for less than $300,000, the amount voted. The most expensive part of the system would be the 10 miles of 14-in. mains to connect Laguna creek with the storage reservoir, which would cost about $105,000.

San Francisco, Cal.—Extensive additions are contemplated. The Spring Valley Water-Works Co. has secured control of the watershed of the western portion of Alameda county drained by Calaveras creek, Arroyo del Valle, Arroyo Mocho, San Antonio, Los Positas, Tassajera, Alameda, and other creeks, covering a territory extending from Santa Clara county on the south to the San Ramon valley, and embracing an area extending over 400 sq. miles, or over eight times that of the watershed of the San Leandro reservoir. A reservoir may be constructed to have a capacity of 500,000,000 galls. There are a number of tributary creeks which may be made feeders. The contour of the valley is such that a reservoir may be readily constructed by building a dam at a point where the hills come near together.

Salt Lake City, Utah.—Four new springs have just been opened at the head of City creek, and an additional daily supply of 2,000,000 galls. obtained.

CANADA.

Winnipeg, Man.—The Special Committee on Water-Power has decided to invite offers from companies for the construction and operation of works subject to the following conditions:

The company to give the city the power required for electric lighting, water-works, etc., at actual cost, not exceeding 2 cts. per day, or $7.30 per year per horse-power; the rate to be charged for business enterprises not to exceed $20 per annum; the company to deposit with the city as a guarantee 10 per cent of the estimated cost of the work in cash, on which 5 per cent. interest will be allowed by the city, the deposit to be held as security until the completion of the works, and to be forfeited if the company fails to complete the work; the works to be constructed and in operation within one year from the date of the offer; offers to be received until the 24th of August.

ARTESIAN WELLS.

Allegheny City, Pa.—Two additional wells are being sunk in the park.

Savannah, Ga.—The Savannah Artesian Hotel Co., will probably sink an artesian well.

Goldsboro, N. C.—The Goldsboro Ice Co.'s well, 200 ft. deep, is now yielding 3,000-galls. per hour.

IRRIGATION.

Chicago, Ill.—CHAS. W. GREENE, Chicago, Ill., is now offering 8 per cent. irrigation bonds of the South Gila Canal Co. for sale.

Dodge City, Kan.—The charter of the South Dodge Canal Co. has been filed with the Secretary of State. Its purpose is to build and maintain an irrigating ditch between the Arkansas river and Ford City. The river is to be tapped on the south side at a point within one mile of section 27, township 26, south of range 25 west, in Ford county. The capital stock is $250,000. The directors are E. E. SOULE; G. G. GILBERT; J. W. GILBERT; J. H. CRAWFORD, and C. M. BEESON.

Gothenburg, Neb.—The town has voted $15,000 of bonds to build an irrigating and water-power canal from the east end of Brady island. It will be 9½ miles long and have a fall of 63 ft.

Redfield, S. Dak.—A meeting has recently been held to discuss irrigation by artesian wells and a committee appointed to report at the next meeting, on Aug 11. The members of the committee are: D. S. HOOKER, of Mellette; ALONZO CHASE, of Redfield and S. P. WATKINS, of Ashton. A committee of one from each township was also appointed to awaken interest and ascertain what can be done in their respective townships.

Idaho City, Idaho.—The *World* states that surveys are soon to be made for a large irrigation system near Minnidoka, in Cassia county. Snake river is to be raised by a dam 33 ft. high, and canals will be taken out on both sides to irrigate 100,000 acres of land, and furnish water for placer mining. The cost will be about $400,000.

Colusa, Cal.—The Central Irrigation District of Colusa county has disposed of $125,000 of bonds.

Corvallis, Montana.—The largest irrigating ditch in western Montana has recently been completed. It is 5 miles long, and connects Bitter Root river with Sleeping Child creek, consolidating with the Republican Ditch Co. MARCUS DALY is the principal owner. It will supply water to his numerous ranches and the farms of the other ditch owners near Corvallis.

Caldwell, Idaho.—Capt. A. ROSSI, of Washoe, has completed the preliminary survey of the extension of the Ridenbaugh ditch. The proposed extension will carry about 30,000 ins. of water, the head of Deer Flat, where the main ditch will end. The terminus of the extension is at a point 50 ft. above the level of the Flat, which will admit of all the land being covered with water. It will cross Indian creek 4½ miles above Nampa, and will be 29 miles long from the point of extension. The estimated cost of the extension is $45,000. Seven miles have already been completed at a cost of $80,000.